[1] Iran. [2] Economic survey board <LC basic
[3] Reports. no. 9 p. 476.

The Honourable John Bracken,

Premier of Manitoba.

Sir,

I have the honour to submit herewith a report on The Forests of Manitoba, being Project No.8 under the Economic Survey, and the ninth of a series of reports covering many phases of the economic and social life of the province. This report is the work of H.I.Stevenson, Provincial Forester, Department of Mines and Natural Resources.

I have the honour to be,

Sir,

Your obedient servant,

C.B.Davidson,
Director.

Winnipeg, Manitoba,
June 15, 1938.

THE FORESTS OF MANITOBA

- by -

H.I.Stevenson
Provincial Forester

ACKNOWLEDGMENTS

The writer wishes to acknowledge the co-operation and assistance of C.B.Davidson, Director of the Economic Survey Board, and Professor H.C.Grant, Chief Research Associate and the staff of the Economic Survey Board for their help and assistance in preparing this report.

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The Dominion Forest Service completed an Inventory of the Forest Resources of Manitoba in 1933 and the result of this work was published in 1934 as Dominion Forest Service Bulletin number 85, by J.D.B.Harrison, B.Sc.F. The writer has made extensive use of this bulletin as the basis for this present report and quotations from Mr. Harrison's report are shown in parenthesis. More recent information has shown that the estimates given in bulletin number 85 were very conservative.

Published by
Manitoba Economic Survey Board
C.B.Davidson, M.A. - Director
H.C.Grant, Ph.D. - Chief Research Associate

June, 1938.

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INTRODUCTION

The forests have always played an important part in the economic life of Manitoba. The great forest areas were the habitat of the game and fur bearing animals, on which our first industry, the fur trade, depended, and the Hudson's Bay Company and the North-West Company built their log trading posts, their York boats and canoes with Manitoba timber. Later, in our history, settlers found abundant timber, generally within a reasonable distance, for the erection of farm buildings and for fuelwood and other purposes. In this respect they were in a much more favourable position than those farmers who settled the open treeless plains to the south and west in the Dakotas and Saskatchewan and who were compelled to live in sod shacks and burn twisted hay or straw as fuel.

As time went on the forests provided timber for saw mills, cross ties for railways and many other purposes, giving employment during the long winter months to men and teams. Many of the early settlers were enabled to carry on and establish themselves on farms with the assistance of money earned in the winter logging camps.

The average citizen, in thinking or speaking of forests, usually sees only the mature tree and its value as timber, forgetting entirely that young trees of the forest, if given proper protection, will provide the timber supplies of the future. They

also generally overlook the fact that supplying us with timber products is only one small function of the forest and by no means the most important. The forests provide shelter and food for our wild life, including game and fur bearing animals. The fur trade is one of our important industries and if the forests were destroyed it also would disappear. The forests also protect our streams and rivers by preventing too rapid run-off of rain and melting snow, in this way regulating stream flow and lessening the dangerous silting up of our water storage basins at the power sites, at which we generate electricity for lighting purposes and power for industries. Successful farming is also dependent to a large extent on the influence of the forests. They tend to reduce the velocity of the wind, lessen evaporation, and, in their immediate vicinity, to moderate the summer's heat and the winter's cold.

The forests are also important in that they provide recreational facilities for our people. They contain many beautiful lakes which attract the tourist traffic, thereby providing a large and very profitable industry.

The forests of Manitoba supply many important industries, provide timber for farm use and give employment, especially during the winter months to large numbers of our people. Without the forests our wild life, on which the fur trade depends, would largely disappear. Their influence on stream flow makes possible the development and maintenance of our numerous power sites. Farming and many other important industries depend largely on the forests for their successful operation. Given continuous protection and proper care, our forests will yield increasing quantities of timber, resulting in turn, in the establishment of new industries and so in increased employment.

CHAPTER 1

HISTORY OF FOREST ADMINISTRATION

DOMINION ADMINISTRATION

Manitoba was created a province of the Dominion in 1870, but, under the provisions of the "Manitoba Act" the government of Canada retained control of all the natural resources, which included the forests.

The history of the Dominion government administration in reference to Manitoba timber followed closely that of other parts of Canada at that time. Every effort was made to sell as much timber as possible to provide necessary revenue, and also possibly to establish lumber industries and provide employment, but no thought was given to care of the forests. Wasteful methods of logging, incomplete utilization and forest fires, which were evidently considered a necessary evil, as no effort was made to control them, soon destroyed the greater part of the splendid original stands of timber.

Sometime previous to the year 1900, realizing the necessity of making some provision for future timber supplies for the province, the Dominion government set aside certain areas which included the present Turtle Mountain and Spruce Woods forest reserves, the Riding Mountain, now a national park, and one other area which was later re-opened for settlement, as timber reserves. Nothing was attempted in the way of supervision or development of these areas but settlement or sale of lands within their boundaries was prohibited.

In 1889 a start was made by the Dominion government in the organization of a forest service and a Chief Inspector of Timbor

and Forestry appointed and given a small clerical staff. The first steps taken by this organization were not, as might have been expected, to care for and protect the existing forests, but were to establish a scheme for supplying young trees to settlers on prairie farms. This work was first carried out at the Brandon Experimental farm but a nursery was later established at Indian Head, Saskatchewan, and millions of trees have since been distributed in Manitoba and the other prairie provinces.

In 1905 the first actual forest surveys were made in order to determine those areas most suitable for setting aside as forest reserves for the perpetual growing of timber. In 1906 the "Forest Reserves Act" definitely established the old timber reserves, the Turtle Mountain, Spruce Woods and Riding Mountain, as forest reserves and also created two new reserves, the Duck Mountain and Porcupine. The administration of these reserves was taken over by the Forestry Branch in 1907, but all forested lands lying outside the forest reserves continued to be administered by the Timber and Grazing Branch of the Department of the Interior, in so far as the disposal of timber and the collection of dues and royalties was concerned. This dual control of the forest resources of Manitoba by the Forestry Branch and the Crown Timber and Grazing Branch continued until the natural resources were turned over to the province in 1930.

In 1912 the boundaries of Manitoba were extended northward to the shores of Hudson Bay and a huge area of forested land added to the province, although most of this district was more or less inaccessible in so far as the settled portions of the province was concerned. The Hudson Bay Railway later opened up some of this

territory. In 1912 the re-organized Forestry Branch was made responsible for fire protection, both inside and outside forest reserves.

The only means of transportation in the early days in a large part of the forested area, and this was particularly true in the case of the northern part of the province, was by canoes in the summer, over the numerous water-ways, and by dog-teams in the winter. As canoes were the only available means of travel, an attempt was made to give these northern areas some measure of fire protection by use of fire patrols travelling in this way. This method was, however, found ineffectual. Fires usually occurred at remote points and, by the time the canoe patrols arrived, reached such large proportions that it was impossible, with their limited equipment, to extinguish them. Realizing this it was decided in 1921 to experiment with the use of aircraft in this type of work. A number of old war-time flying boats were obtained by the Dominion Air Board and a base established at Victoria Beach on Lake Winnipeg. Systems were worked out for the detection of fires by aerial patrol and also for the transportation of fire crews and equipment from nearby points to suppress them. During the first years operation of this aerial fire patrol it was definitely proved that aeroplanes, or rather, seaplanes, provided the only effective means of fire-guarding this great northern area. This Service was improved during the following years and more efficient planes procured. The Air Board providing the planes and flying personnel and the Forest Service the trained fire rangers, fire crews and equipment, and directing the work. The main base was later moved from Victoria

Beach to Lac du Bonnet and sub-bases located at Norway House, Cormorant lake, Beren's River, Winnipegosis and Thicket Portage. In 1923 the Royal Canadian Air Force took over from the Air Board, continuing the work; and the Royal Canadian Corps of Signals co-operated by establishing wireless sets at the different bases and also equipped the detection planes with radio in order to reduce the time required in getting crews to fires. The Royal Canadian Air Force continued this work until the end of the 1930 fire season.

The Sandilands Forest Reserve was established in 1923. This area had been withdrawn from settlement some years previously. In 1927 the Manitoba Paper Company erected a pulp and paper mill at Pine Falls on the Winnipeg river. In order to locate wood supplies for this mill the Dominion Forest Service carried out extensive forest surveys over a large part of the province. Thousands of square miles were photographed from planes, aerial maps prepared and estimates made by ground crews. These surveys, begun in 1927, were completed in 1929.

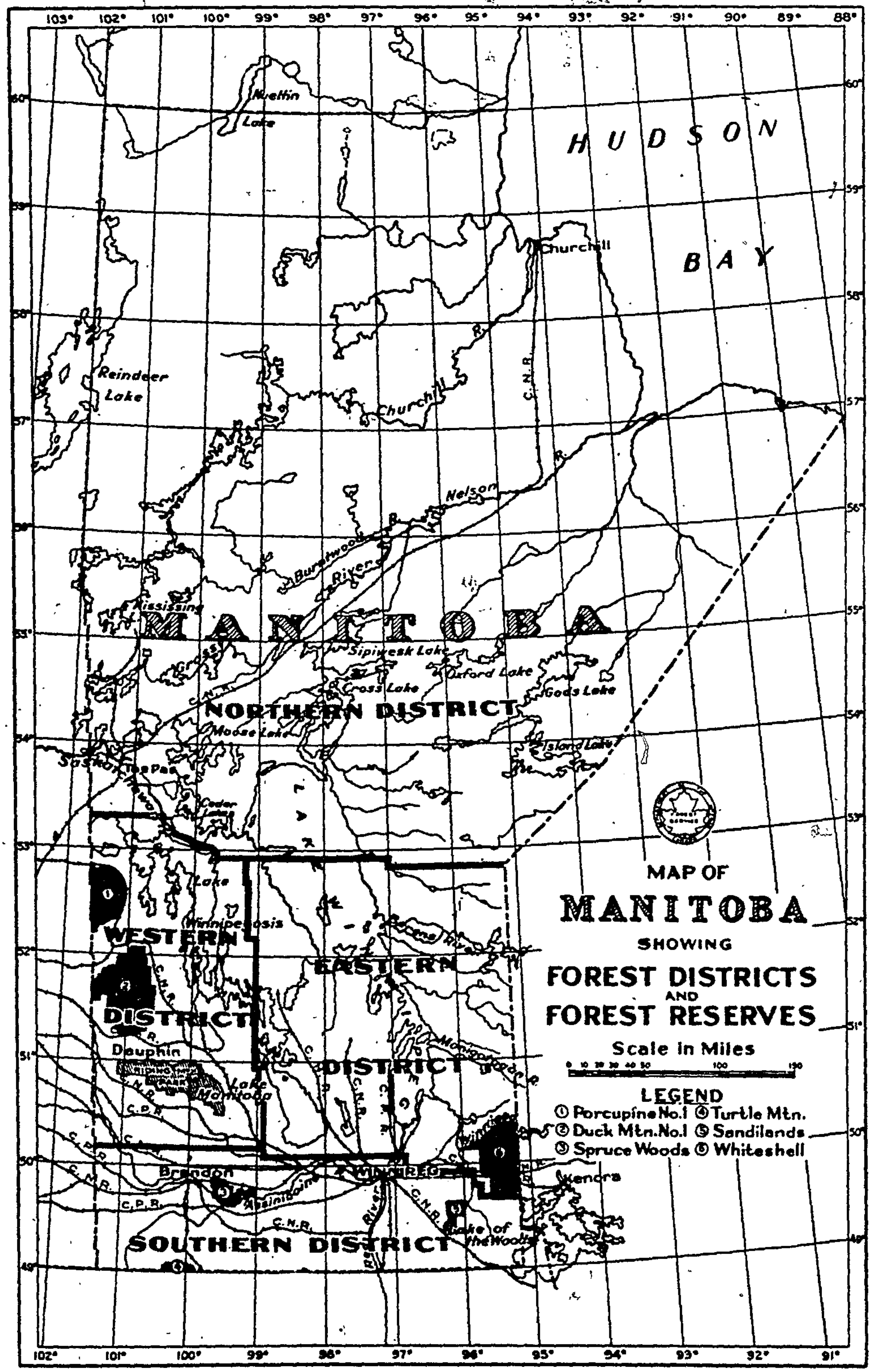
On July 15, 1930, the Dominion government transferred the forests, together with other natural resources, to the province. This included all forest reserves with the exception of the Riding Mountain, which some months previously had been created a National Park and remained under Dominion control. The Whiteshell Forest Reserve was established in 1931, replacing the Riding Mountain reserve retained by the Dominion.

PRESENT ADMINISTRATION

On the transfer of the natural resources the Manitoba Forest Service was organized as a branch of the Department of Mines and Natural Resources. This branch took over all the administration and fire protection work formerly carried out by the two Dominion organizations; the Crown Timber and Grazing Branch and the Dominion Forest Service. The staff of the new provincial forest service was recruited from the trained personnel of the Dominion Services and the policy of conservation and development previously adopted by the Dominion continued and improved.

The Manitoba Forest Service is in charge of the Provincial Forester with headquarters in Winnipeg and to whom the field staff is directly responsible. The province is divided into four Forest Districts, each in charge of a district forester. These forest districts are sub-divided into ranger districts with a forest ranger in charge. The four forest districts are; - The Northern District, comprising, roughly, that part of the province north of the 53rd parallel; the Southern District being, roughly, that portion of the province lying south of the main line of the Canadian Pacific Railway; and the Eastern and Western Districts lying between those two and being divided by a line running north and south, immediately west of Lake Manitoba.

In 1931 seaplanes for aerial forest patrol were provided by a commercial company. Contracting our flying proved expensive and not altogether satisfactory and in 1932 it was decided to procure and operate our own aircraft as part of the Forest Service. The Manitoba Government Air Service was organized and was later set



MAP OF
MANITOBA
SHOWING
FOREST DISTRICTS
AND
FOREST RESERVES
Scale in Miles
LEGEND
① Porcupine No.1 ④ Turtle Mtn.
② Duck Mtn. No.1 ⑤ Sandilands
③ Spruce Woods ⑥ Whiteshell
HUDSON
BAY
Churchill
Reindeer Lake
Churchill
Nelson
Burntwood
River
MANITOBA
Sipiwesk Lake
Oxford Lake
Cross Lake
Gods Lake
NORTHERN DISTRICT
Moose Lake
Island Lake
The Pas
Cedar Lake
Lake Winnipegosis
WESTERN
DISTRICT
Dauphin
Lake Manitoba
EASTERN
DISTRICT
Brandon
Assiniboine
Winnipeg
Kenora
Lake of the Woods
SOUTHERN DISTRICT

up as a separate branch of the Department of Mines and Natural Resources. This Air Service provides planes for all forest activities as well as for necessary flying for other branches of the department. The main air base of this Service is located at Lac du Bonnet where all overhaul and repair work is done. A sub-base is kept open during the summer months at Cormorant lake and two seaplanes stationed there for work in northern Manitoba.

The Provincial Forester is also Director of the Air Service and this arrangement has proved very satisfactory, preventing the friction that generally occurs when two organizations under separate heads are compelled to work jointly at the same task. By operating our own Air Service the cost of aerial fire patrol has been greatly reduced without any loss in efficiency.

The permanent staff is the basis of our fire fighting organization, each district forester and each forest ranger being responsible for fires in his own district. Extra fire rangers, patrolmen and towermen are employed during the summer or during periods of high hazard to supplement the regular staff. As the District Foresters and Forest Rangers are responsible for fires each in his own district, they are careful in seeing that fire hazards are reduced to a minimum, by the proper supervision of cutting, brush burning, etc.

When it has been decided that any stand of timber is mature and should be cut, one of three methods of disposal may be employed:-

1. By permit, without competition, to settlers for timber for their own use and in the case of a few, timber products for limited quantities for sale.

2. Timber sales sold by public competition, for small quantities of timber, good for a period of from one to five years, providing timber supplies for small operators.

3. Licensed Timber Berths, sold by public competition, renewable from year to year for a period of fifteen years, providing timber for the larger sawmills.

All timber cutting operations are strictly supervised, all brush and debris resulting from logging operations must be burned, leaving the remaining forest free from fire hazard in this respect and providing for natural regeneration.

In addition to being responsible for fire protection and supervising the cutting of timber and collection of revenue, the staff of the Forest Service is responsible for care of forest nurseries and field planting, the supervision and administration of summer resorts on forest reserves, cutting of hay and grazing of live stock on reserves and many similar activities.

CHAPTER II

FOREST DESCRIPTION

"General

A statement summarizing the quantities of merchantable timber to be found in Manitoba at a given moment would no doubt be of considerable interest, but by itself it would convey to the reader an imperfect and misleading picture of the forest resources. The most important attribute of a single tree, or of a forest, is its ability to grow. In the past, publicity has been given to certain comparisons of the estimated merchantable wood volume of the country with the annual rate at which wood is being used or destroyed, and from these comparisons deductions have been made purporting to show that the forests of Canada will have disappeared in the course of twenty or thirty years. Any such comparison is absurd in so far as it neglects the growth which is constantly taking place.

"Since the forest is an organic community, it follows that differences in environment will be reflected in modifications of the forest in its growth and composition. These reactions of the forest to environment are commonly observed. It follows, therefore, that a proper appreciation of the forests as a whole can be obtained only if the conditions under which they are grown are known. Those environmental factors which have the most profound effect on tree growth are climate, geological structure, topography and drainage, and soil. While it is undesirable to enter upon too detailed a discussion of environment in a report of this kind, a brief review of the conditions principally determining the composition of the

forest is given in the following paragraphs.

"The opinion that climate is the principal factor governing the distribution and nature of forests is now generally accepted. Climatic conditions particularly affecting the forest are temperature precipitation and length of growing season". These conditions have been worked out in some detail by the Dominion Meteorological Service and the results have been included in another section of the Economic Survey Report.

The outstanding points of interest as far as Forestry is concerned is that there is a small area in the south and west which is naturally grassland rather than forest while there is an area to the north which is naturally tundra rather than forest. The fundamental conditions which determine the limits of the forest formation are climatic. The limits of the forest formation may be somewhat irregular, for instance, an increase in elevation such as that found on the Turtle Mountain and on the Manitoba escarpment changes the climate sufficiently to allow of these heights being covered by forest rather than by grassland. Local eccentricities in the limits of the forest are due to non-climatic agencies such as topography, drainage and soil.

The distribution of the various tree species within the forest formation also depends on climate. For example several species reach their western limits in south-eastern Manitoba where precipitation is higher than it is elsewhere in the province. Several of the hardwoods appear to be limited in their northern extension at about the north end of the Great Lakes of Manitoba by the shortness of the growing season beyond that point. Two of the soft-woods disappear at different points along the Hudson Bay

railway while three others are able to exist practically at the shore of Hudson Bay.

"The most important geological features are the sharp division of the province into areas of ancient granitic rocks and later formations of sedimentary origin, the results of complete glaciation, and the modifications which have taken place in some parts of the deposit of glacial drift.

"The portions of the province to the east and north of Lake Winnipeg are included in the great mass of pre-Cambrian rocks, mainly comprised of granites and gneisses, which is known as the Canadian Shield.

"The western margin of the Shield is approximately indicated by the west boundary of the Coniferous Belt, shown on the map opposite. To the south and west the underlying rocks are sediment - aries, consisting of limestones and some shales, which were laid down under the sea long after the granites of the Shield were formed.

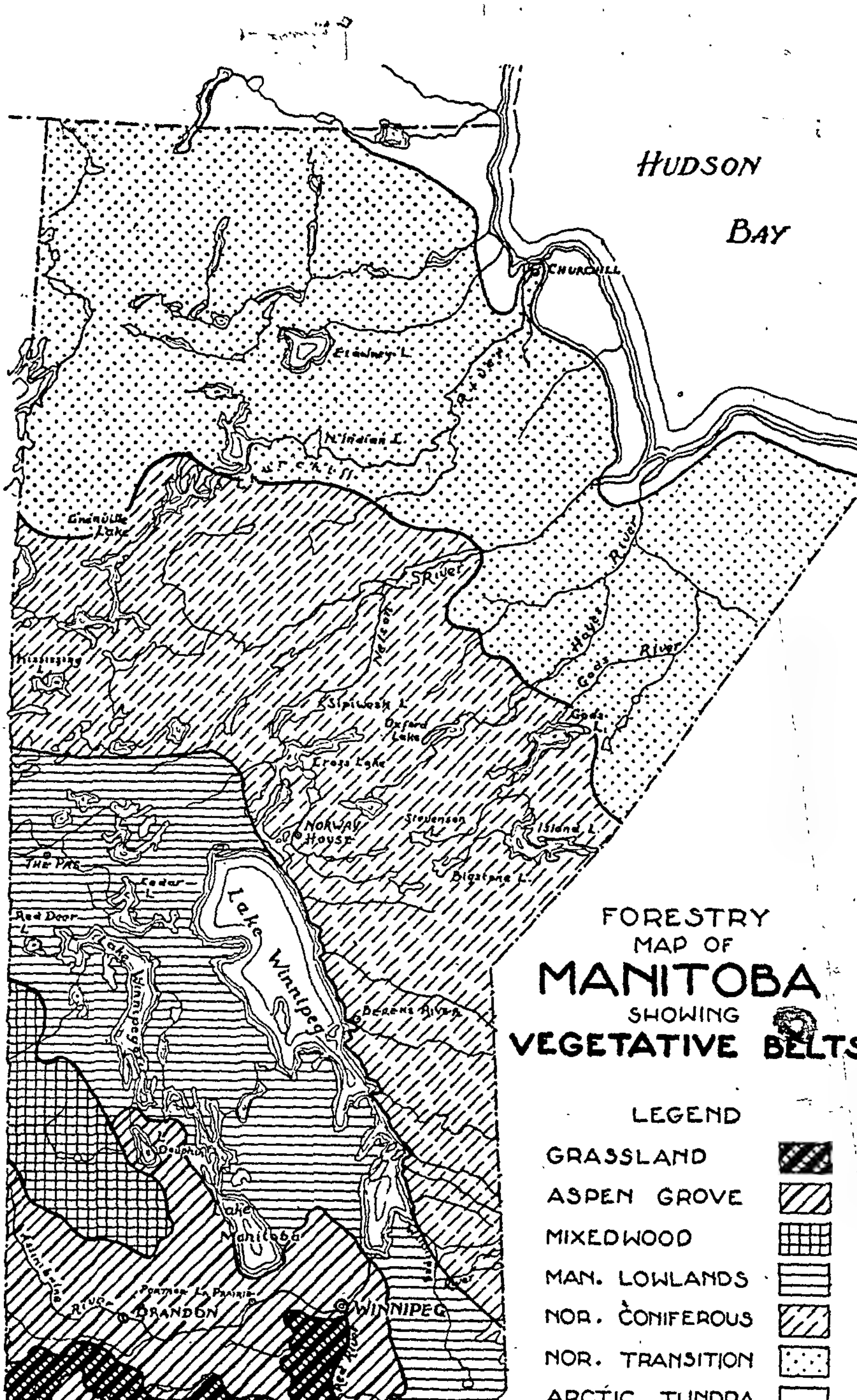
"In many parts of the granitic area the bed rock is either exposed or is very close to the surface, though it is well covered in the clay belt which embraces the valleys of the Burntwood and Grassy rivers. The limestone foundations are usually covered by deposits of glacial drift and silt.

"There was heavy glaciation over the whole of Manitoba during the Ice Age, and the motion of the ice sheet can be traced through the striae still visible on granite exposures. As the glaciers receded towards the north they deposited their loads of clay and boulders, thus giving rise to the soils of the province until in some areas the deposits of glacial drift have been subsequently

modified by wave action or covered with silt, while in others, including some of the true forest lands, the material lies in very nearly the position in which it was originally laid down.

"As the ice retreated, a great body of water known as Lake Agassiz was formed on its southern margin; at different periods this lake covered practically all of the southern part of the province except the highest levels of the Manitoba Escarpment. A smaller lake, known as Lake Souris, was separated from the main lake in the extreme southwest. Many of the farm lands of today were then submerged at depths of several hundred feet. As the glaciers continued to recede, the lake subdivided. Different stages of its recession are marked by a series of low gravel ridges, occurring in the western part of the province, each of which represents a temporary beach. Lakes Winnipeg, Manitoba and Winnipegosis are the present day remnants of this great inland fresh-water sea. The waters of Lake Agassiz and the rivers draining into it modified the glacial drift of the farming areas, and enriched it with their deposits of silt, to form some of the finest grain-growing lands in the world. At one time this prehistoric lake covered all of the area shown on the map opposite as the Manitoba Lowlands, most of the Grassland and Aspen Grove belts, and a large part of the Northern Coniferous belt.

"The topography of the southern half of the province is characterized by a great depression, or catchment basin, occupied in part by the larger lakes, and draining through the Nelson river in a northeasterly direction into Hudson Bay. The general level of this basin is referred to as the first prairie steppe. Commencing near the intersection of the international boundary (the 49th


HUDSON
BAY
CHURCHILL
Nelson River
Hayes River
Gods River
Gods L.
Oxford Lake
Cross Lake
Norway House
Island L.
Stevenson
Bigstone L.
Sipiwesk L.
Granville Lake
The Pas
Cedar L.
Red Deer L.
Lake Winnipeg
Berens River
Lake Winnipegosis
Dauphin
Lake Manitoba
Portage La Prairie
Brandon
Winnipeg
FORESTRY
MAP OF
MANITOBA
SHOWING
VEGETATIVE BELTS
LEGEND
GRASSLAND
ASPEN GROVE
MIXEDWOOD
MAN. LOWLANDS
NOR. CONIFEROUS
NOR. TRANSITION
ARCTIC TUNDRA

parallel of north latitude) and the 98th meridian of west longitude, and extending in a northwesterly direction, there is a discontinuous chain of hills known as the Manitoba Escarpment. This chain marks the transition between the first and second prairie steppes, and includes the Pembina Hills in the south, and the Riding, Duck and Porcupine Mountains. It is characterized by steep slopes towards the east and northeast, and reaches elevations up to 2,700 feet above sea-level. The elevation of Lake Winnipegosis is 831 feet, that of Lake Manitoba 814 feet, and that of Lake Winnipeg 715 feet. East of Lake Winnipeg the land rises towards the Ontario boundary to an elevation of about 1050 feet. Except for the hills of the escarpment, the surface of the province is of low relief, varying from the approximate dead level of the swamps and some of the grass lands to a low rolling surface where elevations of more than 100 feet above the surrounding terrain are somewhat unusual. The general northeasterly slope of the northern areas is shown by the courses of the Nelson and Churchill Rivers.

" The origin of the agricultural soils as glacial till or boulder clay has been previously referred to. Most of the forest soil in the Manitoba Lowland is due to the same source, but the deposits have been subsequently much modified by wave action. The soils are mainly fine sandy loams and clay loams, and in some places contain a considerable amount of stone. In the southeast there are extensive areas overlain by peat and muck. The forest reserves with two exceptions owe their soil to the terminal moraines or heavy marginal deposits of the glaciers. The surface soils are similar in composition to those just mentioned. The Spruce Wood

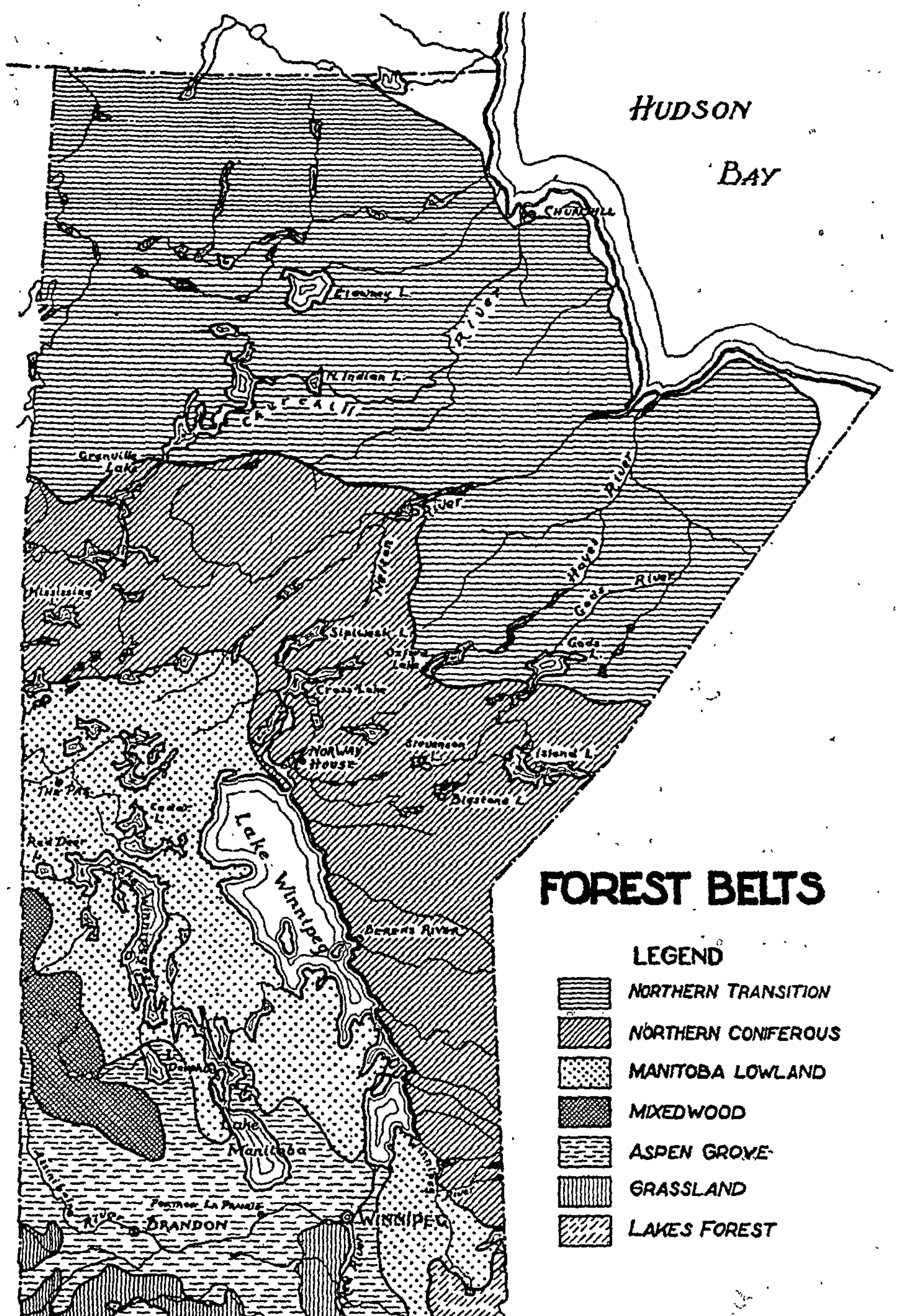
area differs from the others in that it is composed of sand dunes formed by wind action on deposits of an old delta of the Assiniboine river, and the Whiteshell reserve lies on the Canadian Shield. Parts of the Northern Coniferous belt are overlain by lacustrine deposits, but on the granites of the remainder the soil is thin, and except in the narrow stream valleys is almost entirely of vegetable origin. Depressions in the rock, when not occupied by small lakes, contain muskegs with sphagnum moss as the dominant vegetation. On the low rocky ridges, forests are found growing on soils only a few inches in thickness. Apparently these soils have been built up from the remains of a succession of plant forms, commencing with lichens which attached themselves to the bare rock, and passing through successive stages, dominated in turn by mosses, flowering plants, low shrubs, and, finally, coniferous forest. Such forests, growing on a mat composed of the remnants of previous occupants of the area, are particularly susceptible to fire damage, since not only trees, but the soil also, may be destroyed - a condition of affairs startlingly reflected in the large areas of bare rock now to be found on the Canadian Shield. In the stream valleys, local deposits of silt afford good growing conditions for trees, but these areas are relatively limited in extent.

FOREST BELTS

"The foregoing descriptions of the climatic and soil conditions have indicated that there is in Manitoba a considerable variation in those factors which together constitute the environment in which plants grow. Since groups of vegetation are directly affected both

in their constitution and growth by environmental conditions, it is natural to expect that certain areas can be defined in which approximately uniform conditions of growth have resulted in the dominance of specific groupings of vegetation. The delimitation of such areas is based on both the known similarity of growing conditions and the actual occurrence of certain plant communities as dominants. A division made in this way is known as a vegetational belt. In the province there are seven such belts of major importance, which are shown on the map on the following page. Of these seven, the Grassland to the south and the Arctic Tundra to the north are not forested, and may, therefore, be omitted from further discussion. The remaining divisions constitute the forest belts, which are designated as the Aspen Grove, Mixedwood, Manitoba Lowland, Northern Coniferous, and Northern Transition belts. In the southeast there is a small intrusion of one other belt, but, as its area is small and its boundaries somewhat uncertain, it has been considered as part of the Manitoba Lowlands. There are also some relatively small "islands" in the Aspen grove belt which should be classified as Grassland, but which have been omitted from the map for the sake of simplicity.

"The location of the belt boundaries is approximate rather than absolute, since between any two belts there may be a zone of transition in which the principal forests partake of the characteristics of each belt. It must also be borne in mind that any of the forms of forest occurring in the province may be found in several or all of the belts. The conception of a forest belt does not exclude such occurrences, but is based on the dominance of



HUDSON BAY
CHURCHILL
FOREST BELTS
LEGEND
NORTHERN TRANSITION
NORTHERN CONIFEROUS
MANITOBA LOWLAND
MIXEDWOOD
ASPEN GROVE
GRASSLAND
LAKES FOREST
Lake Winnipeg
Lake Manitoba
WINNIPEG
BRANDON
Portage La Prairie
Norway House
Cross Lake
Sipiwesk L.
Island L.
Bigstone L.
Gods L.
Gods River
Hayes River
Nelson River
Berens River
Cedar L.
Red Deer L.
The Pas
Granville Lake
N. Indian L.

certain specific forms in different localities.

THE TREES OF MANITOBA

"The tree species fall naturally into two distinct groups, which are commonly described as softwoods and hardwoods. It is more correct to refer to the softwoods as conifers, and to the hardwoods as broad-leaved species, since the relative hardness of the wood of the two groups is subject to wide variations. For example, the wood of jack pine is harder than that of the aspen, although the latter species is included in the hardwood group. All of the softwoods are cone-bearing, carrying their seeds naked at the bases of the cone-scales; all have needle-like foliage, except the Eastern white cedar, and all are ever green except the tamarack, which sheds its leaves for the winter. The hardwoods have broad leaves, their seeds are encased in fruits or nuts, and in Canada they are all deciduous.

"In comparison with the forests of other parts of Canada those of Manitoba are of simple composition. The common and botanical names of the tree species are shown in the following schedule;-"

Common Name	Botanical Name
Softwoods	
White pine	Pinus strobus
Red pine	Pinus resinosa
Jack pine	Pinus Banksiana
Tamarack	Larix laricina
White spruce	Picea glauca
Black spruce	Picea mariana
Balsam fir	Abies balsamea

Common Name	Botanical Name
Hardwoods	
Aspen (white poplar)	Populus tremuloides
Balsam Poplar	Populus balsamifera
Large toothed Aspen	Populus glandidentata
Cottonwood	Populus deltoides
Peach-leaved willow	Salix amygdaloides
White birch	Betula papryifera
Bur oak	Quercus macrocarpa
White elm	Ulmus americana
Manitoba maple	Acer negundo
Basswood	Tilia glabra
Green ash	Fraxinus pennsylvanica lanceota
Black ash	Fraxinus negra
Hackberry	Celtis occidentalis

"More than ninety per cent of the wood cut in Manitoba for the use of industry is supplied by the softwood species. The demand for hardwoods for manufacturing purposes is very limited, although the quantity used for fuelwood is very large. The following notes on the tree species of the province embody short descriptions of the trees with remarks on their chief uses:-

White Pine (Pinus strobus L.)

The White Pine ranges from the Atlantic to Eastern Manitoba, where it extends about 18 miles west of the Ontario boundary from the Winnipeg River south to the International Boundary. It is widely planted in Europe under the name of Weymouth Pine.

The tree occasionally reaches a height of 175 feet and a diameter of 5 feet. The largest known trees in Manitoba at the present time are about 20 inches in diameter. The bark is smoother than that of the other eastern pines, greenish-brown when young and greyish-brown in old age. One of the main characteristics which separates the tree from the other eastern pines is the arrangement of the soft, delicate, bluish-green needles in groups of fives.

White pine lumber varies in colour from the light-creamy in the sapwood to creamy-brown or sometimes reddish-brown in the heartwood.

The wood is light, soft and easily worked, is easily seasoned, holds it shape and takes nails well. On the whole this is one of the choicest of all Canadian woods and has a great variety of uses such as pattern making, ornamented carving and the construction of all parts of buildings except heavy structural timbers.

Red Pine (Pinus resinosa Ait)

Another common name for this tree is Norway Pine although it is not native to Europe. Its range in America is very similar to that of White Pine although it extends somewhat further north and west.

In Manitoba its western range is the Sandilands Forest Reserve and Black Island in Lake Winnipeg. The merchantable timber remaining is extremely limited in extent, but there is some promising young growth.

The Red Pine reaches a size of from 75 to 125 feet high and 2 to 3 feet in diameter. The trunk is very straight and clear of branches for a considerable portion of its height. The bark is reddish-brown in colour and separates into broad, flaky scales. The dark-green leaves are 3 to 6 inches long and are borne in a bundle of two. The tree is very ornamental in appearance due mainly to the clear reddish trunk and the heavy tufts of leaves at the ends of the branches.

The wood is pale yellow to light red in colour and is soft, light, tough, moderately strong and easy to work. The better

grades of red pine serve for many purposes to which white pine is put.

Jack Pine (Pinus banksiana Lamb)

The range of Jack Pine in Canada is from Nova Scotia to the Athabasca river in Alberta and north to Great Bear Lake. The southern limits in Manitoba are everywhere slightly north of the limit for tamarack and spruce (see below), while the northern limit is very considerably south. The northern limit may be more particularly described as running from the north-west corner of the province south-east to the Hudson Bay railway near Kettle Rapids and thence to Sturgeon Lake on the Ontario boundary.

Jack Pine reaches its best development in western Ontario, Manitoba and Saskatchewan, reaching a height of 80 feet and a diameter of 18 inches or larger. When found in pure stands on good sites it has a straight, clear trunk, but on rock or dry sand sites it is often small and crooked.

The bark is reddish-brown in colour and rough-scaly at the surface. The needles are in bundles of two like the Red, Scotch and Lodgepole pines, but are shorter than any of them, being only ½ to 1½ inches long and have a characteristic yellow-green colour.

Jack Pine wood varies in colour from creamy-white to brownish-yellow. It is heavier, harder and stronger than white or red pine, but is harder to work. The timber is widely used in Manitoba for railway ties, fuelwood and lumber. It is one of the chief woods used by Canadian paper mills in the manufacture of sulphate or Kraft wrapping paper. Small quantities of the wood are exported from the province to the United States for this purpose. There is a possibility that Jack Pine may be used at some future date in the

manufacture of bleached sulphate pulp for newsprint paper.

Jack Pine is one of the most important of the forest trees of Manitoba, mainly on account of its suitability for railway ties and fuelwood. It grows readily on land suitable for no other purpose, and reproduces itself freely after fire or cutting. The rate of growth is comparatively rapid and stands of small fuelwood size may be produced in 45 years.

To produce higher quality timber such as railway ties and lumber the rotation is about 65 years on the better sites and up to 100 years on the poorer sites. When the timber is cut at this age large quantities of fuelwood are obtained from the tops of the saw-log trees, as well as from the trees which are too small for timber. Reproduction is entirely from seed and takes place readily when the mature trees are felled, the cones opening at this time and spreading their seed.

<u>Tamarack (Larix laricina Koch)</u>

Other common names are larch, American larch and Hackmatack.

The natural range is from Labrador to the Rocky Mountains and north to the mouth of the McKenzie river and the northern limit of tree growth. In Manitoba it extends practically to the shore of Hudson Bay in the north. The southern limits are of considerable importance as they agree for all practical purposes with the southern limits of white and black spruce, or in other words, they mark the southern limits of the Coniferous forest. The line starts at Vita, near the Minnesota boundary, through St. Pierre Jolys, St.Anne de Chenes, Anola, east of the Red River to Lake Winnipeg, from Matlock on the west side of Lake Winnipeg

to the vicinity of Lundar on the east side of lake Manitoba, across the lake to a point north of Amaranth, west to the slope of the Riding Mountain near Norgate, south around the Riding Mountain through Birnie, Clan William, Elphinstone, Inglis and up the Assiniboine river to the Saskatchewan boundary. It is largely confined to muskegs and for that reason may be absent along those portions of the southern limits described above, where the site is upland.

Tamarack is also found along with spruce in two areas outside the ordinary southern limits. One of these is at Bird's Hill, north-east of Winnipeg, and the other is in the Epinette swamp, which extends south-east from Douglas through the Spruce Woods Forest Reserve to the Assiniboine River.

This tree varies greatly in size and rate of growth, depending on drainage conditions. In muskegs with no drainage it reaches a size suitable only for small fence posts; in better drained swamps it reaches a diameter of one foot or more, while on well drained land where it is found only occasionally, it may reach a diamter of 2 feet or more and a height of 70 feet. The rate of growth ranges from extremely slow to fairly fast, depending on drainage conditions. As the weight and hardness of the wood depends on the rate of growth there is a widely held, although erroneous belief, that we have two different species of tamarack.

The trunk is straight and the tree soon clears itself of branches. Young trees and the new growth on old trees have a smooth gray bark, while the bark of older trees is reddish or grayish brown, separating into flakes. The needles are short, pale green in spring, turning orange-yellow in the fall and

dropping off before winter.

Tamarack has the heaviest and strongest wood of our softwood trees. On account of its durability it is a favourite for railway ties, fence posts, culverts and bridge material. In the early days it was one of our most valuable species, being used in railway construction, structural timber, etc. The introduction of the European larch sawfly led to an epidemic which swept across the continent from the east, reaching Manitoba some time previous to 1910. This insect by repeated defoliation caused the death of practically all the mature tamarack in Canada. At the present time we have very extensive stands of young growth about 25 feet high, resulting from the seed of the dying trees. European insect parasites were established here in 1913 with the object of controlling the sawfly, but the future of the tamarack is uncertain. Dead timber of the older generation is still being taken out in large quantities as fuelwood, the tamarack being the best of all the softwoods for this purpose.

Subject to the uncertainty regarding insect attack the tamarack is a very important forest tree. It reproduces readily from seed in suitable locations and grows fairly rapidly in early life. Maturity for small products such as posts is reached at about 50 years and for sawlogs at about 100 years.

White Spruce (Picea glauca Voss)

The white spruce is native to all parts of Canada except southern British Columbia, the prairie parts of Manitoba, Saskatchewan and Alberta, and the extreme north. In Manitoba it has practically the same limits as tamarack (already described), except that white spruce is found on the well drained site while tamarack

occupies the lower sites. It is found south of its ordinary southern range on the sand-hill area of the Spruce Woods Forest Reserve, and also on Bird's Hill, near Winnipeg.

This species seems to reach its best development in western Manitoba and eastern Saskatchewan. Trees have been measured which were over 4 feet in diameter and 125 feet in height, but the more usual maximum on the better sites is about 2 feet in diameter and 80 feet in height.

The bark is fairly smooth in early life and grayish-brown in colour. As the tree gets larger it becomes flaky and reddish-brown in colour. The needles are short, four angled and arranged singly. The cones are $1\frac{1}{2}$ to 2 inches long and usually fall off shortly after the seed ripens in the fall.

The wood is light cream in colour, being lighter in colour as well as harder than white pine. The spruce, unlike the pines and tamarack, do not vary in colour from sapwood to heartwood. The wood is light in weight, stiff, tough and very strong taking weight into c nsideration. It has a fine, even grain, is easy to work and does not split easily. The lumber seasons well, is tasteless, odorless and comparatively free from resin.

White spruce is the most important of the lumber producing trees of Manitoba and is used extensively for building purposes, particularly for joists, studding and light structural purposes in general. It is also used for siding, flooring, sheeting, sashes and doors and for inside and outside trimming. It has largely replaced white pine for these purposes and competes in the local market with Douglas fir, western cedar and western spruce from

British Columbia. Nearly all the lath manufactured in Manitoba is white spruce, being manufactured largely from slabs.

Box factories use spruce to a large extent on account of its toughness, strength, lightness and nail-holding qualities. Its lack of taste and odor fit it for food containers such as butter boxes.

White spruce is the most important commercial tree in Canada as a whole, occupying first place in pulp production and second in the lumber industry. The various spruces are recognized as the most important pulpwood species in north America, due to their long, tough, colourless fibre and comparative freeness from resin. These qualities particularly fit them for use in the ground-wood and sulphite processes which are used in the manufacture of news-print paper.

White spruce is a slow growing tree in early life, but accelerates its growth after about the 20th year. In the forest it may be considered to be mature for pulpwood at about 80 years and for lumber at about 120 years, although the age will vary greatly with the site. It is best handled under the selection system of cutting, that is the larger trees are taken out as they mature, leaving room in their place for reproduction which usually takes place by seeding. In this system the whole spruce area is gone over about every 10 to 20 years, but the forest is never clear-cut.

<u>Black Spruce (Picea mariana B.S.P)</u>

Black spruce has practically the same natural range in Manitoba and in Canada as white spruce, except that it is usually confined to the poorer drained sites, while the white spruce

occupies those which are better drained.

The usual size is from 35 to 40 feet in height and 6 to 9 inches in diameter. Occasionally when it is found growing on higher land it reaches a diameter of 16 inches and a height of 80 feet. In undrained muskegs on the other-hand it may have a height of only a few feet.

The bark is grayish-brown and becomes very flaky in the older trees. The bark underneath the flakes has a yellowish tinge. The needles are shorter than those of the white spruce and blunter in the point. The cones are spherical in shape when open and usually stay on the tree for several years after the seed has been shed. Young trees have a regular and symmetrical outline, but the older trees develop drooping branches and a narrow, irregular crown.

As black and white spruce occasionally grow in the same stand it may be of interest to outline the characteristics by which the two species are most readily separated. The simplest distinction is in the colour of the bark underneath the bark flakes, this is always reddish in white spruce and yellowish in black spruce. The crushed needles of white spruce have a pungent, skunk-like odour when crushed, while those of black spruce are merely resinous. The cones of black spruce are roundish and have stiff, easily broken scales, with ragged edges, while those of white spruce are cylindrical and have flexible scales, which are smooth on the margins.

The wood is very similar to that of white spruce and cannot be readily separated from it. Due to the tree's habit of slower growth it usually has narrower growth rings, and on that account is heavier, stronger and more durable.

Black spruce is logged for lumber where the two species are

mixed. Its main use is for pulpwood and here its slow growth habit results in a greater production of wood-fibre per cord than from white spruce. It is also used for mining timbers and fence posts in preference to white spruce. Nearly all Christmas trees sold in Manitoba are black spruce.

Black spruce is one of the most important forest trees in Manitoba. It occupies huge areas of poorly drained land on which no other tree will grow and in the more northerly districts grows on higher land with thin, rocky soil. It reproduces readily from seed and in addition has a peculiar method of its own, known as "layering". This occurs on mossy sites where the lower branches becoming buried in the moss take root and then turn the tip of the branch up to form a new tree.

Balsam Fir (Abies balsamea Mill)

This tree is also popularly named balsam. It is found from Nova Scotia westward and northward to Great Slave Lake and the Yukon Territory. In Manitoba the southern limit is about the same as that of Jack Pine (see above) while the northern limit is considerably short of that of Jack Pine, running from the south end of Reindeer Lake on the Saskatchewan boundary to the Hudson Bay railway near Manitou Rapids, east to Swampy Lake on the Hayes River and to the Ontario boundary.

The Balsam fir never reaches the size of the spruce, the maximum being about 15 inches in diameter and 60 feet in height. The bark is very smooth and marked with raised blisters which contain Canada Balsam. The needles are usually two-ranked along the twig, and unlike the spruce are flat, blunt-tipped and without a stalk. The cones stand erect on the branch and when ripe their scales drop

off, leaving the stalk standing.

The wood is whiter than spruce or any other softwood, light in weight, soft and weak. It is used for lumber, usually mixed with spruce, also for lath. It is an excellent pulpwood on account of being colorless, fairly free from resin, and having long tough fibres, going mainly into newsprint along with spruce.

The Balsam Fir reproduces itself very readily particularly in old spruce-balsam stands which have not been disturbed by fire. In some cases its management is a problem, due to its coming in after the more valuable spruce has been logged. It never reaches the great age of spruce, being usually somewhat defective by the time it is 80 years old.

Eastern White Cedar (Thuja occidentalis L)

Other common names for this tree are cedar, white cedar, northern white cedar and arbor-vitae.

The distribution of our cedar is from Nova Scotia to Manitoba. It extends into Manitoba from the Lake of the Woods to Lake Winnipeg and also has an isolated range around Cedar Lake and the north end of Lake Winnipegosis, also on the Warpath River.

It is usually a small tree about 45 feet in height and 1 foot in diameter, but it occasionally runs up to 70 feet in height and 2 feet in diameter. In undrained peat swamps it may occur as a small stagnated tree, along with black spruce.

The bark is reddish-brown, thin and shreddy, often with a spiral twist. The leaves are very small and scale-like, in pairs on opposite sides of the twig and arranged in four rows, completely covering the branchlets, overlapping like shingles.

The cones are small, from 1/3 to 3/4 inch long.

The wood is very ~~light~~, soft and comparatively weak, fine, even and straight grained. It is brown in colour and has a pleasant aromatic odour. It is one of the most durable of our woods and for that reason is used for fence posts and for telephone poles.

Cedar is slow-growing and long-lived; trees have been found which ere 300 years old. It should ordinarily be cut at around 120 years as it is subject to heart-rot as it gets older. Reproduction takes place fairly readily from seed in openings made in the stand.

2. Hardwood Trees

Aspen (Populus tremuloides Michx)

This species is commonly known as white poplar in Manitoba.

The natural range covers practically all of Canada except the northern barren lands. The northern limits are slightly south of that of white birch. In the south the white poplar extends to Kentucky in the east and into Mexico on the western side of the continent. Over wide portions of its range, where other hardwoods are dominant, the poplars may be almost absent, but tends to come in after fire or logging. In the prairie provinces they tend to form a belt of almost pure poplar, changing gradually to prairie on the south and to a poplar-spruce mixture on the north.

In forest conditions aspen will reach an extreme height of 90 feet and a diameter of 2 feet. In prairie conditions the size will be much less.

The tree is characterized by smooth, white bark which becomes ash-gray and furrowed in old trees. The leaves are mounted in such a way that they flutter at the slightest breeze. All the poplars, cottonwoods and willows produce catkins, usually in the early spring.

The wood is light, tough, odorless, easy to split and moderately hard when seasoned. It holds nails better than spruce. It requires skill in seasoning, but those who have had experience are able to produce good seasoned lumber.

The amount cut as lumber is small, mainly because spruce is so available. In districts where there is no spruce, farmers use a good deal of poplar for building. It may be used satisfactorily for dimension material, sheeting or in any place where it is not exposed to weather. It is used for flooring, particularly stable flooring on account of its fine grain, toughness and good wearing qualities.

Poplar is the leading wood used in the prairie provinces for boxes and crates, excelsior and wood fibre for gypsum plaster. It is one of the best woods for barrels used to hold foodstuffs. As veneer it is used for fruit baskets and three-ply.

The favorite wood for matches in Great Britain and northern Europe is the European Aspen (Populus tremula L) which is very similar to our white poplar. Large quantities of poplar matches are imported into Canada yearly.

Poplar is one of the commonest woods used in the soda process of pulp manufacture. The resulting pulp is used as a filler to the extent of about 40 per cent mixed with 60 per cent of the longer

fibred spruce, in the manufacture of the better grades of book and magazine paper. Poplar pulp is also used extensively in the manufacture of wall-board. It may be used satisfactorily in the wood distillation industry.

It is one of the leading fuelwoods of the province, the larger part of the wood being cut by farmers on their own land and for their own use, although considerable quantities are shipped to the cities and towns both from private and from government lands.

Aspen is one of the most important forest species in the province. It reproduces readily, mainly from root-suckers, although denuded areas far from other poplar may be reforested by wind-blown seed, if moisture conditions are favourable. Poplar is a valuable nurse crop for the more valuable spruce and as a matter of fact most of our best white spruce of large size comes from areas of mixed spruce and poplar. Poplar usually shows signs of decay from heart-rot at about 40 years, but despite this disease it occasionally reaches an age of 100 years or more. For fuelwood it should be cut at 40 to 50 years to get the greatest annual return of reasonably sound wood. For lumber it will usually have to be left until it is 60 to 80 years old.

Balsam Poplar (Populus balsamifera Duroi)

This tree is commonly known as Black Poplar in Manitoba.

The natural range in Canada is practically the same as that of Aspen, except that the Balsam Poplar is usually found on the moister locations and the Aspen in the dryer.

It has a slightly larger diameter than Aspen, occasional trees reaching a diameter of 4 feet at breast height, but the height is

about the same.

The bark turns dark and becomes furrowed much earlier in life than does the Aspen. The buds are noticeably large and sealed with a fragrant sticky gum.

The heartwood soon turns dark, giving the lumber from large trees a brown colour, quite different from the light coloured lumber of the Aspen. The lumber is used for the same purposes as Aspen, except that it is not satisfactory for flooring. It makes a better veneer wood. As fuelwood it is much inferior.

Cottonwood (Populus deltoides Marsh)

This tree is found from Quebec westward throughout southern Ontario and in the southern part of the three prairie provinces. In Manitoba it is confined in its natural state to river valleys and is known to occur naturally only as far north as Dauphin.

The Cottonwood can be distinguished from the other poplars in winter by the yellowishness of the twigs. The leaves are triangular in outline and coarsely toothed.

The wood is used for the same purpose as Aspen, but is more valued as lumber on account of it producing wider boards free of defect. It is used for waggon boxes and as veneer for laminated board.

Reproduction takes place naturally by sprouts from the stump, and the tree may be propagated artificially from cuttings. A great deal of seed is produced from the seed-bearing catkins which are borne on separate trees from the male catkins, but this seed seldom germinates.

Native Willows

The peach-leaved willow (Salix Amygdaloides Anders) is the only one which reaches a large size, occasionally up to 50 feet in height with a diameter of 18 inches. This willow has a single trunk, unlike the other native willows, and is found along river banks as far north as the Assiniboine River. The wood is seldom used, except for fuel and fence posts. The annual shoots are suitable for basket making, resembling those of the Almond Willow, which is one of the standard willows used in Europe for that purpose.

Manitoba has, in addition to the one tree-like willow mentioned above, about five species of medium size, large enough to make small fence posts. They are as follows:-

Shining Willow	(Salix lucida Muhl)
Sandbar "	(Salix interior Rowlee)
Pussy "	(Salix discolor Muhl)
Beak "	(Salix bebbiana Sarg)
Heart-leaved willow	(Salix cordata Muhl)

These medium sized willows are usually shrub-like, that is they have several stems from the same root. They occasionally reach a height of 25 feet and a diameter of 5 inches. Some of them are of considerable value as fence posts as their durability compensates for their small size. Some of these willows appear to be suitable for basket making, due to their rapid growth of new shoots.

White Birch (Betula papryrifora Marsh)

The white or paper birch is found from Labrador and the Maritime province westward to Yukon territory and the north Pacific coast. In Manitoba it does not extend quite as far north as spruce and tamarack, stopping about 30 miles short of Hudson

Bay. It extends south to the Turtle Mountain with poplar, but may be missing over wide areas.

The ordinary size in the forest is about 50 feet high and from 8 to 10 inches in diameter, although occasionally it reaches a height of 70 feet and a diameter of 18 inches.

White birch is noted for its paper-like bark and fine spray like branches, smaller branchlets having a dark metallic lustre.

The wood is not so heavy and strong, but is tougher than the eastern yellow birch which is so widely used for flooring and furniture. The white birch when of sufficient size can be used for similar purposes and also in woodblock pavements, spools, clothes pins and a great variety of small woodenware. The main uses in Manitoba at the present time are for fuelwood and for the manufacture of railway shims.

Birch in the forest reproduces itself readily by shoots from the old stumps as well as from seed. It is not a long-lived tree and should be cut at about 60 years unless extra large sized material is required.

Bur Oak (Quercus macrocarpa Michx)

This tree is found growing naturally from Nova Scotia to the western boundary of Manitoba. In Manitoba it ranges from the International boundary north to Mafeking on the west and to the Berens River on the east.

When growing on rich alluvial flats it may reach a size of 70 feet in height and 3 feet in diameter. It is also found growing on dry, gravelly ridges, where it is often called "scrub" oak, due to

its poor form. In many cases these small trees have huge roots showing that the trunk has been repeatedly killed by prairie fires.

The wood is very strong and durable and is equal in quality to the white oak, which is used so much for furniture. It is used locally for fence posts for which its durability particularly fits it and is also sawn into lumber for furniture factories. It produces a very high quality fuelwood.

Bur oak reproduces itself readily both by sprouts and from seed.

American Elm (Ulmus americana L)

The natural range of this tree extends from Nova Scotia to central Saskatchewan. In Manitoba it extends from the International Boundary north to The Pas on the western and to the Bloodvein River on the eastern side of the province.

This tree is one of the largest and stateliest of the Canadian hardwoods, although in Manitoba it seldom exceeds a height of 70 feet and a diameter of 3 feet. In our climate it does not naturally spread outside the alluvial clay deposits of the river valleys.

The wood is heavy, hard and tough and these mechanical qualities make it of considerable importance in industry as well as for various uses around the farm. The timber is used extensively in slack cooperage for staves, hoops and headings, in furniture, boxes, implements and machinery, and hockey sticks. Large quantities of this timber are available particularly along the Red and lower Assiniboine, of a size and quality suitable for use in manufacturing.

Manitoba Maple (Acer negundo L)

This tree is also known as Box Elder or Ash-leaved Maple, doubtless in reference to the fact that the leave is compound as in elder and ash, rather than maple-like in the accepted sense of the word.

The natural range in Canada is confined to the south - western peninsula of Ontario, the Lake of the Woods region, Manitoba, Saskatchewan and eastern Alberta. It extends south in the United States to Florida and Texas. In Manitoba it has a similar range to that of elm, but has spread by planting and seeding from planted trees since settlement commenced.

It reaches a height of from 50 to 75 feet in forest conditions, but in shelter belts on the prairie will not usually exceed 40 feet. The trunk is apt to be somewhat crooked and tends to a shrub-like habit.

The wood is lighter in weight than any of the other maples, but is used locally for boxes and rough construction. Trees are tapped yearly for maple sap in some of the outlying districts.

Basswood (Tilia glabra Vent)

The Basswood, also called Linden or Lime, ranges naturally from New Brunswick to the western border of Manitoba. With us it is confined entirely to the river flats and does not extend north of the south end of Lake Manitoba and Winnipeg.

It reaches a height of 50 to 60 feet and a diameter of from 1 to 2 feet in Manitoba. It is characterized by large, heart-shaped, somewhat one-sided leaves which give very heavy shade. The bark is dark grey and smooth when young, gradually becoming furrowed. The fruit consists of small, round and woody balls

like peas, which are attached to the centre of the midrib of a narrow leaf-like bract.

The wood is light coloured and of uniform fine texture. On account of being so easy to work and so uniform it is a favourite for cheaper grades of furniture.

Green Ash (Fraxinus ~~pennsylvanica~~ lanceolata Sarg)

The natural range of Green Ash in Canada is from southern Quebec, through southern Ontario, Rainy River and Lake of the Woods, Manitoba and Saskatchewan. It extends south from this line through the United States to Florida and Texas. In Manitoba it is found as far north as The Pas, having about the same northern limit as elm.

Its usual height is from 30 to 40 feet, although it occasionally reaches a height of 50 feet. It is a fairly fast growing straight-boled tree with compound leaves and stiff coarse twigs.

The wood is strong and tough and well suited for fence posts, implement parts, and is an excellent fuel.

Black Ash (Fraxinus Nigra Marsh)

Black Ash has a natural range from Nova Scotia to Lake Winnipeg, but it is not known to occur west of the Red River.

It is usually confined to river bottoms and swamps where it reaches a height of 60 to 70 feet in height and 18 inches in diameter.

The Black Ash is distinguished from the Green Ash by having 7 to 11 sessile leaflets in the compound leaf while the Green Ash has from 5 to 9 stalked leaflets.

The wood is used in eastern Canada for interior finish, fixtures and furniture, but no special uses have been developed for it in Manitoba.

CHAPTER III

FOREST LANDS

One of the greatest hazards to our forests, and one which has been responsible for the destruction of large areas of timber, was the indiscriminate settling of lands throughout the wooded areas, generally on lands totally unsuitable for agricultural purposes. Clearing such lands necessitated the falling and burning of trees and it is safe to say that for every acre cleared in this way, one hundred or more acres of valuable adjoining timber was destroyed, as a result of fire spreading from such clearings.

Before any land settlement was permitted a complete and thorough classificiation of all lands in the province should have been made by soil experts and economists to determine the proper and most suitable use of each area, whether for agricultural or ranching purposes, or whether it would have been more profitable to prohibit settlement in certain areas and permanently dedicate such land to the growing of trees. To allow settlement on unsuitable or submarginal lands, on which it was impossible for a farmer to make even a bare living for his family under normal conditions, was a crime against the individual and agaist the community as a whole, for in the end the province must make up the deficiency by relief in some form.

Unfortunately in the early days of settlement and until the transfer of the natural resources, no attention was given to restricting

farm settlement to lands suitable for agricultural purposes, and the individual settler who may have had little or no knowledge of soils or climatic conditions and often did not even have farming experience, was allowed to enter upon the land at will. The result has been disastrous; these people cannot secure a living from such soils and have almost ruined many of the best forest areas. They turned in many cases to wood cutting for a living and have heavily overcut forests near such settlements.

Since the transfer of the natural resources to the province great care has been exercised by the Land Board in preventing a repetition of those early mistakes. No land is disposed of unless it is found, after careful examination, that it is possible for a settler to make a fair living under normal conditions. Scattered settlement throughout the forested area is not permitted and where it is found that any land is most suited for the growing of trees, it is reserved for forestry purposes.

Movement of Population

While we now have controlled settlement, past errors have not been corrected, and except in odd cases where the settler has been driven by starvation from these submarginal lands, probably owing to the fact that the timber in his neighbourhood has been cut out or burned, and the game destroyed, the hazard to the forest still exists, and this problem should be faced now or as soon as it is possible to do so.

The solution is the simple one of moving these people to suitable lands on which they can produce a fair living by farming

and turning their present unproductive lands back to the Crown for the growing of forests, which is their proper use.

Where it is possible to do so, in this necessary movement of this unproductive portion of our population to lands on which they can make a fair living, they should be moved to suitable unoccupied lands within the present municipalities where roads, schools and churches already exist and where they can become established with the least effort and at the minimum of cost. This will also bring these unoccupied municipal lands back on the tax rolls and in this way lighten the burden of such municipalities.

From a forestry standpoint the movement of these settlers from forested or potential forest areas, will greatly reduce the fire hazard and general cost of forest administration and it will then be possible to grow valuable forest crops on those and adjoining lands where at present we are growing little or nothing.

FOREST RESERVES

Certain areas in the province have been set aside or reserved for the perpetual growing of timber and all lands within the boundaries of the respective reserves are permanently withdrawn from disposition, settlement or occupancy, except under provisions of the Forest Act and Regulations. The lands included in the forest reserves are generally unsuitable for agricultural

purposes, being rough broken ground, poor soil and unsuitable for the cultivation of field crops. These reserves are generally well situated for the purposes intended, that is, to supply timber to farming communities and to provide recreational facilities for the people. They are mostly located in the southern part of the province and many of them are entirely surrounded by settlement.

In addition to providing present and future timber requirements and recreational grounds they are also sanctuaries for big game and fur bearing animals, and provide cover for many of our game birds. With few exceptions they contain large numbers of lakes, usually well stocked with fish.

The total area of the forest reserves in Manitoba is 3,811.09 square mailes, being 1.5 per cent of the total area of the province. The following is a list of the forest reserves, together with a brief description of each;-

1. Turtle Mountain Forest Reserve
2. Spruce Woods Forest Reserve
3. Duck Mountain Forest Reserve
4. Porcupine Forest Reserve
5. Sandilands Forest Reserve
6. Whiteshell Forest Reserve

The Turtle Mountain Forest Reserve

The Turtle Mountain forest reserve with an area of 109.25 square miles, is situated south of the town of Boissevain and immediately north of the International boundary. This area was first set aside as a timber reserve some time previous to 1900 and established as a forest reserve by the Dominion government in 1906. It occupies a

a series of low hills rising from the surrounding plains which extend some distance south into the United States. Practically the whole of the hilly or mountain area on the Canadian side was included in the reserve, while on the American side, the land has been divided into rather poor farms. The soil is a terminal moraine, originating in the great glaciers. Growth on this area is luxuriant.

When this reserve was established by the Dominion government in 1906, it had been burned over repeatedly and was practically denuded of timber, only a few small areas of mature poplar in some of the lower and wetter areas remaining. Careful protection from fire and prohibition of cutting until recent years has had wonderful results. This area is now almost entirely covered with a healthy stand of young aspen, which is the dominant tree, with a considerable quantity of oak, ash, elm, birch and willow scattered throughout the poplar stands. None of the conifers occur naturally in this district but several fine plantations of spruce and pine, planted some years ago have now reached a height of from 25 to 30 feet. Coniferous plantations are rather difficult to establish in this area, owing to the rank growth of herbaceous matter.

The cutting of timber of any kind on this reserve was prohibited by the Dominion government, but, during the recent drought period, settlers were allowed to remove a limited quantity of fuel-

wood for their own use. A careful study of the existing stands of timber and growing conditions was made last year and a tentative working plan prepared. This allows the removal of 2,000 cords of fuelwood each year for the next five years. After that period the quantity which may be cut will be increased and it is expected that within 15 years the supply of timber available will be greater than the demand, unless new markets are found.

In addition to providing fuelwood and timber for the repair of farm machinery for the district, this reserve is of the greatest benefit to farms lying immediately to the north as it protects them from the hot south winds which dry out the crops. During the drought period, farms lying north of this reserve produced fair crops when land to the west of it produced nothing. There are a large number of lakes scattered over this reserve, two of which have been developed as summer resorts. These lakes provide nesting grounds for water fowl and water for grazing stock.

A large number of cattle and horses owned by farmers in the surrounding district graze on this reserve during the summer months. In some years as many as 3,000 head being pastured and 2,000 tons of wild hay are put up for winter use on the farms.

The Turtle Mountain Forest Reserve is also a Game Preserve Deer are to be found in large numbers and muskrat, and other fur-bearing animals, are plentiful. During years of normal rainfall this is one of the best duck shooting districts in the province.

Large numbers of ducks breed in the lakes and migrating birds in the fall stop over on their way south. Prairie chicken and partridge are numerous throughout the area.

The Spruce Woods Forest Reserve

The Spruce Woods was also one of the old timber reserves and was created a Dominion Forest Reserve in 1906. It lies east of Brandon and south of Carberry and is 223.5 square miles in area. The reserve consists of two blocks, the larger lies north of the Assiniboine river and the smaller to the south of it, in the neighborhood of Cypress River and Glenboro.

The soil is sandy and has been blown into rolling hills by wind action. While most of the dunes are now fixed and covered with vegetation, in several places advancing sand dunes are encroaching on the low-lying muskeg areas. The soil originated from the old delta of the Assiniboine river.

The timber on this reserve is mostly spruce (this being the south-western limit of this tree in Manitoba), interspersed with poplar on the better soils. The northern block is cut from northwest to southeast by a low-lying muskeg area which contains a fairly good growth of tamarack along its margin. While spruce predominates on the high ground, it is not a suitable species for this site. Spruce is a shallow rooted tree, usually growing on good clay soils while this area is almost pure sand. Spruce

on this area deteriorates rapidly after reaching 60 or 70 years of age and makes poor lumber, whereas on good sites with clay soils, it will live for 120 years and reach large size. The soil, however, is perfectly well suited for the growing of pines, and planting has been confined to this species. Native jack pine and lodgepole pine from the Cypress hills in southern Alberta and Scotch pine from the Baltic states have all proved successful and make excellent growth. Red pine from south-eastern Manitoba is also being planted but some years must elapse, before we can be sure, that it is sufficiently hardly to withstand the winters in this district.

A certain amount of grazing has always been permitted on this reserve but, it must be carefully controlled. Over-grazing will destroy the grass cover and may start sand drifting, which if allowed to persist would eventually cover and destroy the fertile adjoining farm lands.

In addition to assisting very materially in holding the sand dunes on this area, the forest cover has a marked influence on farming conditions by lessening the velocity of drying winds, particularly on those farms lying north of the reserve.

A certain amount of dry spruce and green poplar has been cut for fuelwood from this reserve during the last few years and at the present time we are permitting the removal of some of the older spruce, showing deterioration, for saw timber. This is

being manufactured into lumber locally by a portable sawmill.

The western part of the Spruce Woods forest reserve is also a game preserve. Both moose and deer are found there; the latter are numerous. Prairie chicken find protection in those hills. Owing to the almost entire lack of water, waterfowl are seldom seen, although the only lake of importance, Lake Sewell on the western side of the reserve, is visited by geese during their fall migration.

The Duck Mountain Forest Reserve

The Duck Mountain was created a forest reserve in 1906 and contains an area of 1426.29 square miles. It lies to the north and west of the town of Dauphin and south of Swan River. A part of this range of hills extends west into Saskatchewan and is a Saskatchewan forest reserve.

The soil of this range of hills is usually a fairly heavy clay mixed with boulders. The soils had their origin in glacial moraines and, while unsuitable for farming, they are well adapted to forest growth. Owing to the elevation of this area which reaches 2700 feet, frosts may occur during almost every month of the year.

This is probably one of the best forest reserves in Canada and contains, in addition to the mature timber, large areas of excellent young white spruce, which reseeded following the disastrous fires of 1885 and which will provide fine saw timber in

another 35 or 40 years, if given protection. In addition to the splendid stands of white spruce this reserve has fairly large areas of pure black spruce, our best pulpwood species. Jack pine occurs in pure stands in limited quantities on the eastern side of the reserve and also in a mixture with black spruce in the central areas. Poplar occurs in the spruce or poplar mixedwood type, or in pure stands, the latter particularly in the west side of the reserve. The mature tamarack of course on this reserve were killed by the larch sawfly some thirty years ago. Large areas of young tamarack have replaced those stands.

Realizing the future possibilities of this excellent forest area, a working plan was prepared for this reserve insofar as white and black spruce is concerned, and put into effect two years ago. When surveys are completed other species will be included in this plan. It may be interesting to note that this reserve is the largest area in Canada under silvicultural management, only one small area in the east being similiarly controlled. Under our management plan only an amount of timber equal to the annual growth may be removed from any stand and all trees are individually marked for removal. By this method not only will the volume of timber in the stands be gradually increased, but the quality of the timber will be improved.

The central part of the Duck Mountain is a game preserve and contains moose, deer, elk and practically all the fur bearing animals, with waterfowl on the numerous lakes. This reserve contains some of the finest lakes in the province and is only excelled in this

respect by the Whiteshell Forest Reserve in eastern Manitoba. Most of these lakes are well wooded along the shores and are well stocked with fish of various kinds. It is to be expected that in the future this reserve will be one of the best recreational areas in the province.

The Porcupine Forest Reserve

This reserve lies north of Swan River and directly north of the Duck Mountain forest reserve. The Canadian National Prince Albert line runs along the eastern and northern sides, the west boundary being the dividing line between Manitoba and Saskatchewan. The area of this reserve is 774.75 square miles. The Porcupine Hills are very similar in formation to the Duck Mountains, the soil having its origin in glacial moraines. The steep northerly and easterly slopes lead up to a plateau of broken ridges and contain numerous lakes, some of large size. Tree species on this reserve are the same as those previously described for the Duck Mountain forest reserve.

Probably more saw timber has been cut from the Porcupine forest reserve than from any area of the same size in the province. Many of the largest sawmills secured their supplies from this source a few years ago and several mills are still operating. Unfortunately fires occuring some fifty years ago and again in 1919 destroyed enormous quantities of valuable timber so that while there are still important quantities of mature timber, the greater part of this reserve is covered with young growth which will not reach merchantable size for another 30 or 40 years..

The Porcupine is an excellent game area, moose and deer being very plentiful and fur bearing animals numerous, principally owing to the fact that very few roads or trails have been constructed and most of the reserve is more or less inaccessible.

The Sandilands Forest Reserve

The Sandilands reserve, which lies south and east of Winnipeg was established in 1923. It has an area of 189.3 square miles. The soil is sandy and particularly well adapted to the growing of jack pine. Reproduction of this species is exceptionally good, the cones, contrary to usual habit of this species, opening on the trees and re-seeding unstocked areas. While jack pine in pure stands covers practically the whole reserve, black spruce and poplar occur on the lower lying and better types of soil in limited quantities. This area is also the western limit of Red or Norway pine, a few scattered trees being occasionally found on the reserve.

This area, prior to its being created a forest reserve, was repeatedly burned over, with the result that the older trees were badly fire scarred and spoiled. The change in this area since 1923 is remarkable. The whole area, with few exceptions, is now covered with a very rapid growing stand of jack pine. Railway ties and boxwood are the principal timber products secured from this area and tops of trees or other waste parts are converted into fuelwood and sold in Winnipeg. Thinnings from young stands will in the future find a ready market in the city.

Deer and moose are fairly numerous in this area and woodland caribou are found along the western boundary.

The Whiteshell Forest Reserve

This reserve, which lies east of Winnipeg and along the Manitoba-Ontario boundary, was established by the government of Manitoba in 1931 and has an area of 1088 square miles. It lies on the margin of the Canadian Shield and is of granite formation; contains a number of large streams and over two hundred lakes, many of them fairly large.

The timber on this reserve is typical of the northern coniferous forest. Black and white spruce, poplar, jack pine and tamarack being the principal species, together with cedar and a few red and white pine. This area contains fairly heavy stands of timber which, owing to its proximity to markets, is especially valuable.

The trans-Canada highway running east from Winnipeg cuts across the southern portion of this reserve through a region of lakes. Summer resorts have been established on six of these and as this reserve is developed others will be opened on the more northerly lakes. This is by far the most beautiful lake area in western Canada. The fishing is excellent in the northern portions of the reserve. This reserve will develop very rapidly as a recreational area.

Extension of Forest Reserves

Only 1.5 per cent of the total area of Manitoba, or 3811.9 square miles, have been set aside as permanent forest reserves; much less than in other western provinces. When money is available to develop them, and to provide the necessary staff, further areas of non-agricultural land, suitable for growing trees, should be withdrawn from sale or settlement and created forest reserves,

even if this should mean moving settlers from such non-agricultural lands to better farming districts.

TREE GROWTH IN MUSKEGS

Manitoba has large areas of muskeg, many of which are situated only a short distance east and south east of Winnipeg. Some of these muskegs are fairly well covered with black spruce, tamarack and occasionally with cedar. Unfortunately many of these tress are stunted, owing to unfavourable growing conditions and many of them only reach three or four inches in diameter at one hundred years of age. The reason for this slow growth is, of course, the excessively wet condition of these areas and the fact that ice, protected by the moss covering these muskegs, is present only a few feet below the surface during a greater part of the year, limiting the annual growing period of the trees and preventing necessary root expansion.

It has been found by experiments carried out in Finland, Sweden and by the Lake States Experiment Station in Minnesota, that if the water level in certain types of muskegs is lowered to a point about three feet below the surface, a remarkable increase in growth of those trees not permanently suppressed, takes place. In some cases the annual growth increased as much as six hundred per cent.

In Finland drainage of muskegs is now being undertaken on a fairly large scale as a regular forest practice and gives profitable returns on the money expended.

In many places in Manitoba where ditches have been constructed in connection with drainage schemes or the building of railroads

and roads across muskeg areas, a remarkable increase in tree growth may be observed within the influence of such ditches.

Experiments should be made in lowering the water tables in the more accessible muskegs in order to determine whether this sytem of reclaiming these practically waste areas might not be profitably employed.

CHAPTER IV

FOREST INVENTORY OF MANITOBA

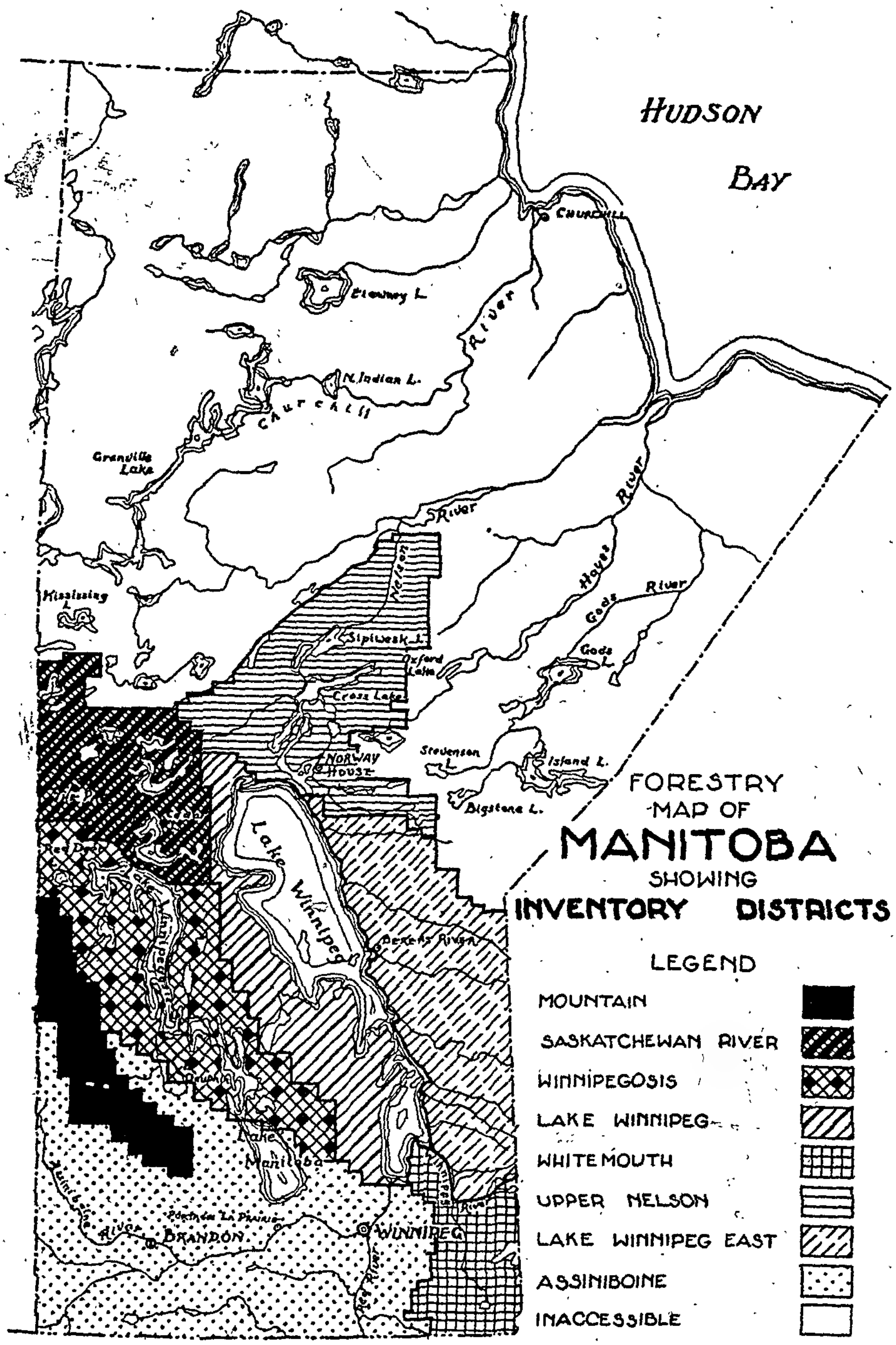
Information under this heading falls "into two principal classes; namely, the area classification and the volume estimates.

"The area classifications indicate the present distribution of the lands of the province, under certain standardized headings, in square miles. The volume estimates show the quantities of merchantable timber existing at the time of writing, in terms of either feet board measure or cords, and also the equivalent volumes in cubic feet of standing timber. As far as the immediate needs of industry are concerned, the volume estimates contain the essential information, but, from the point of view of the forests as a whole, the area classifications are of greater importance, since they include the young growth upon which the supplies of the future depend. Estimates of volume are considered to be quite conservative.

"The information outlined above is supplemented by estimates of the current rate of depletion from various causes, and by estimates of the growth which is constantly tending to offset the losses incurred. A comparison of these two factors show what is now happening in the forests, and what future result may be expected if present conditions continue."

Subdivision of Area

"In order to prepare descriptions of a large area, it is necessary to subdivide it into units of convenient size. The first step in dealing with the forests of Manitoba is the elimination of the inaccessible areas. The accessibility of a tract of forest is


HUDSON
BAY
FORESTRY
MAP OF
MANITOBA
SHOWING
INVENTORY DISTRICTS
LEGEND
MOUNTAIN
SASKATCHEWAN RIVER
WINNIPEGOSIS
LAKE WINNIPEG
WHITEMOUTH
UPPER NELSON
LAKE WINNIPEG EAST
ASSINIBOINE
INACCESSIBLE
CHURCHILL
N. Indian L.
Churchill
River
Granville Lake
Kississing L.
Hayes River
Gods River
Gods L.
Sipiwesk L.
Oxford Lake
Cross Lake
NORWAY HOUSE
Stevenson L.
Island L.
Bigstone L.
Lake Winnipeg
Berens River
Lake Manitoba
Dauphin
BRANDON
WINNIPEG
Portage La Prairie

determined by its availability for commercial use, and is based on its actual distance from market, the transportation facilities which are available and, in the case of some particular localities, on the amount of wood which is present. The last-mentioned consideration depends on the fact that, where a large quantity of wood is to be found, it may be worth while to go to considerable expense to improve the existing means of transportation, since the capital expenditure will be spread over a large volume and the cost per unit will not be greatly increased. In the case of a small amount of wood such expenditures might be quite out of the question. In a study such as this, the standard of accessibility must be of a broad nature. In general, the division adopted includes not only those areas which are now commercially accessible but also those which may become so in the next twenty-five years. There are a few small bluffs of pulpwood not far north of the Hudson Bay Railway, here classed as inaccessible, which might conceivably be cut within that time, but their importance does not warrant their consideration at present. At the same time there are a few areas ~~east of Lake~~ Winnipeg which are now classed as accessible, but which could not profitably be cut at present; they may, however, become available through changes in the transportation facilities. It should be mentioned that this somewhat vexed question of accessibility is also affected by the market price of the forest products. High prices extend the field of accessibility; low prices restrict it.

"The accessible part of the province is divided into eight districts for inventory purposes, which are shown on the map.

"The divisions are based on the boundaries of the forest belts already described. Since all estimates were prepared by districts, the similarity of environmental conditions within a belt was of great importance in makeng estimates for areas about which specific data were lacking. Some of the belts are divided into two or more districts for the sake of greater convenience. These divisions correspond closely with known minor variations within the belts. Since the belt boundaries cannot be located with absolute precision, the district boundaries in some cases follow the nearest lines of existing land surveys."

The definition of accessible area given by the map of Inventory Districts attached is used when considering estimates of available timber and young growth below.

It must be pointed out, however, that changing conditions are opening up considerable timber in the area classed as inaccessible. For example the development of mines at Island, God's and Oxford lakes has made the surrounding timber accessible to the mines for building material, including lumber for mining timber to be used underground and for fuelwood to develop power. There is also the strong probability that timber on the Grass River west of the Hudson Bay Railway may soon become available.

<u>Land Tenure</u>

"A separate report has been prepared for each of the Inventory Districts. In each case the estimates are given separately for the different classes of land tenure, in order that the relative importance of the different kinds of timber holdings may be seen.

Lands—are held under various conditions of tenure, some of which are of greater importance than others. Five standard classes have been recognized in this report, according to the groupings shown hereunder."

Timber Licenses

"This classification includes all Crown Timber Berths which are held under license. It also includes one or two permit berths of a special kind which have been in existence for so long that they are quite comparable with license berths."

Pulpwood Leases

"This class is confined to the holdings of the one pulp and paper company in the province which were granted under a special arrangement. Grants of further licenses of this kind require legislative action."

Forest Reserves

"This group includes all the forest reserves and also the Riding Mountain National Park. The park is not under the control of the Provincial Government, but such wood as is cut from its lands is used in Manitoba, and it must, therefore, be considered as among the forest resources available in the province."

Vacant Crown Lands

"These lands are the property of the Crown, and no timber rights on them have been granted under license or lease. Wood cut from them is obtained under annual permits or from small timber sales."

Alienated Lands

"Under this class are included all lands privately owned, lands belonging to corporations (including the grants to the Hudson's Bay Company and the railways), Indian Reserves, and School lands. Indian Reserves have been disposed of under treaty and naturally fall into this class. The case of the school lands is somewhat different in that they are still under the control of the Government, but since the revenue derived from their sale or from the forests cut from them is reserved by statute for a specific purpose,, it has seemed best to consider them under this heading."

"It will be noted that, of the five classes of land tenure recognized, the first four and the school lands are still the property of the Crown."

AREA CLASSIFICATION

"A separate descriptive classification is made of the areas in each class of land tenure in each of the inventory districts. The principal divisions recognized are non-forested lands, lands bearing non-productive forests, and lands bearing productive forests.

"Non-forested areas include those under cultivation, grass lands, open muskegs and swamps, bare rock, and brushland. In the case of the Assiniboine district an extra class is recorded to take care of areas used for roads and in townsites. In the other districts the importance of these items did not warrant their separation.

"Non-productive forests are areas which, although bearing trees, cannot be expected to produce timber of merchantable size

under existing conditions. They include treed muskegs, treed rock, and dry sites. The treed muskegs bear black spruce and tamarack, whose growth is permanently stunted by excessive moisture or the acid condition of the peat soil. Treed rock occurs commonly in the districts of granitic formation. It is found after fires which have destroyed most of the soil and may be described as a collection of individual trees, each of which is rooted in a small pocket of soil resting in a crevice of the rock. Growth to merchantable sizes is prevented by the absence of room for root development and by lack of nutrients. Dry sites are represented in Manitoba by very limited areas of sand dunes, where the scattered trees fail to reach a useful size owing to lack of moisture and poor soil conditions.

"Productive forests include all areas now bearing merchantable timber or carrying young growth capable of attaining merchantable size. They are divided according to the principal forest types, and the areas in each type are further subdivided into merchantable timber and into three age-classes of young growth. Merchantable areas are defined as lands bearing at least two cords per acre of wood, contained in trees having a minimum diameter of four inches at breast-height (four and one-half feet above the ground) and of an age in excess of sixty years. It is true that as much as two cords per acre can often be cut from stands less than sixty years old, but this practice is a serious mistake (except sometimes in the case of poplar) since the productive capacity of the soil is not fully developed at so low an age. It follows that such young stands should not be considered as among the present merchantable resources."

FOREST TYPES

"The productive forests are classified according to cover-types. A cover-type is defined on the basis of the tree species of which the stand is at present composed, and the relative dominance of these species. The types are three in number, known as softwood, hardwood, and mixedwood types. The softwood type contains 75 per cent or more of coniferous species, the hardwood type 75 per cent or more of broad-leaved trees, and the mixed-woods include all other combinations. These main types are recognized in the area classifications.

"The types are further divided into subtypes, each of which is described by the names of its dominant constituent species, for example the Black Spruce and Jack Pine subtype, and the White Spruce and Aspen subtype. Subtypes are not recognized in the tabular estimates, but are referred to in the descriptions of individual districts.

"The cover-type classification is the only one which it is practicable to use in a study of this kind, but it has one serious drawback which requires mention. Since it is based entirely on the representation of species at the moment, it makes no allowance for the changes and possible improvements which may take place in the constitution of any given type as time goes on. Such alterations are known as successional changes, and are sometimes of very great importance. Without entering into a discussion of this phase of forest development, it may be mentioned that there is for any given set of environmental conditions a definite form

of forest which is known as the climax for the site in question. At times the climax form may be wiped out by fire or some other agency, and a temporary forest of different species may take its place. This forest will gradually tend to revert to the climax form if it is not again disturbed. A typical climax forest is found in the White Spruce and Aspen mixtures of the Mixedwood belt.

ESTIMATES OF VOLUME

"The products of the forest are bought and sold according to a number of units established by common use and commercial practice. The greatest volumes of wood disposed of are enumerated in terms of feet board measure or in cords. There are also a host of minor products, including railway ties, telegraph and telephone poles, and fence-posts, which are sold by the piece, and still others, such as building logs and piling, which are measured in linear feet. While these diversified units are satisfactory enough for purposes of the market, they have the marked disadvantage that measurements made in terms of one product cannot be directly converted into terms of one of the others. It is possible, however, to convert any of them into terms of the equivalent volume of standing timber which is, on the average, required for their production. All the estimates given hereafter are expressed in foot board measure or in cords, and the totals are subsequently converted into their equivalents in cubic feet of standing timber in order to obtain a uniform basis of comparison.

"In the tabular statement of wood utilization, quantities of lumber, pulpwood, railway ties, fuel, and other products are shown separately in order to indicate the relative importance of the different uses. The totals are subsequently converted to cubic feet.

"The foot board measure is considered as a board one foot in length, one foot in breadth and one inch in thickness. As the unit is small, it is customary to speak in thousands, and the written symbol for this quantity is M Ft. B.M. The converting factor used for expressing 1,000 feet board measure in cubic feet of standing timber is 219.

"The cord is a measure of stacked wood based on a standard pile eight feet long, four feet wide, and four feet high. It, therefore, contains 128 stacked cubic feet. The factor used for converting quantitites of coniferous wood from cords to cubic feet of standing timber is 117. In the case of hardwoods, which are used chiefly for fuel, the factor is 95.

"The cubic foot of standing timber is the ideal unit of measurement from the scientific point of view, but very few people in this country are accustomed to its use. Therefore the totals in cubic feet are also expressed by their equivalents in cords, in order that the quantities referred to may be easily grasped.

THE QUESTION OF DRY TIMBER

"A very considerable quantity of dry timber is cut each year from trees which have died. This material is used chiefly for fuel,

but in the case of tamarack it is accepted for railway ties and some other purposes. Some trees are killed by fire, but a greater number die from natural causes owing to the competition of neighboring trees or from the attacks of insects or fungi; in any case, they cease to be a part of the growing stock of the forest. It has been found to be totally impossible to estimate either the quantity of dry wood which occurs in the forests at a given time or the volume of the trees which will die in the future. The death of certain individuals is a feature which is characteristic of the growth of any stand from youth to old age, since the number of trees on an area is always reduced as age increases. When dead trees are cut and used, the operation may be considered as salvage, since it prevents a total waste. The percentage of the dead wood in the province which is salvaged is relatively small.

"Since trees which have died are no longer part of the growing forest, it is permissible to eliminate them from further discussion. They may be considered as a by-product of the growing forest. The volume estimates given hereafter are concerned solely with living or green timber.

CHAPTER V

SUMMARY OF LAND CLASSIFICATIONS AND ESTIMATES

ACCESSIBLE FORESTS

"Tables 1, 2, 3, and 4, on the following pages, summarize the information regarding land tenure, area classification, and volume of merchantable timber. Tables 1 and 2 show the distribution of classes of land tenure for the districts and for the accessible forests as a whole. In Table 3 are shown the summarized classifications of lands within the different kinds of forested and non-forested areas, and Table 4 gives the quantities of merchantable wood which are estimated as available at the time of writing. The classification of areas is given in square miles. Definitions of the land classes recognized have been given on page 54. It will be noted that the percentage distribution of land classes, given at the right-hand side of Table 3, is based on net land area. The percentage of the total area occupied by land and water is also shown.

"In Table 4 estimates of volume are given in the first instance in cords, except in the case of the two spruces, for which there is a separation of saw-timber (in FT. B.M.) from pulpwood (in cords). In the case of these species data were available which made it possible to estimate--at least approximately--what portion of the total wood volume is likely to be used for the production of lumber, and how much, in the ordinary course of events, for pulp. This separation depends on the size of the timber, its location, and the class of tenure under which it is held. The influence of land tenure may be illustrated by the case of a pulp

company which may purchase a timber limit and use the wood for its mill, although at the same time a lumber company may be sawing logs which, on account of their small size, would be more suitable for pulp. In the case of species other than spruce, there is no way of determining the use to which the wood will be put. Jack Pine, for instance, may be made into lumber, pulp-wood, fuel, railway ties, or telephone poles. Since ultimate use cannot be foretold, the total estimate is given in cords.

"The estimates for each species are converted into their equivalents in cubic feet of standing timber. The total cubic volumes of softwoods (conifers) and hardwoods are shown at the foot of the table, and these totals are also expressed in cords. These final totals include quantities previously described under FT. B.M. along with those first given in cords.

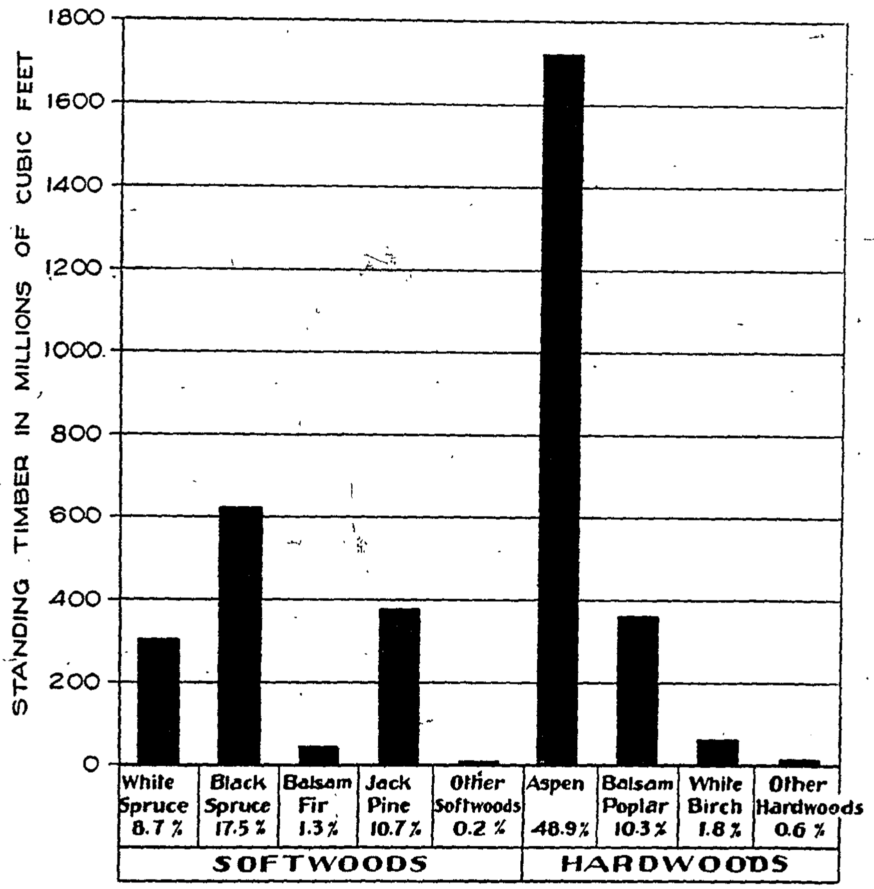
"The total estimate of conifers is 1,357,686,000 cubic feet, or 11,604,000 cords, and that of hardwoods is 2,170,560,000 cubic feet, or 22,848,000 cords; the total for all species is thus 3,528,246,000 cubic feet, or 34,452,000 cords. The percentages of the volumes of conifers and hardwoods contributed by the different species are as follows:-

TABLE F.- VOLUME OF THE VARIOUS SPECIES, IN PERCENTAGE OF TOTAL VOLUME

Species	Per Cent of Conifers	Per cent of Hardwoods	Per cent of Total volume
White Spruce	22.5		8.7
Black Spruce	45.6		17.5
Balsam Fir	3.4		1.3
Jack Pine	27.9		10.7
Other Conifers	0.6		0.2
Aspen		79.6	48.9
Balsam Poplar		16.8	10.3
White Birch		2.9	1.8
Other Hardwoods		0.7	0.6
Totals	100.0	100.0	100.0

MERCHANTABLE VOLUME OF TIMBER IN ACCESSIBLE AREAS

MANITOBA



"If all trees of ten inches diameter at breast-height and over are considered as being suitable for saw material, and their ultimate probable use is ignored, then the accessible forests of the province may be estimated as follows:-.

TABLE G.- SUMMARY OF VOLUME OF WOOD IN ACCESSIBLE FORESTS OF MANITOBA

Species	Saw material, M FT.B.M.	Small material, cords	Total cubic volume, M. cu.ft.
	Conifers		
White and Black Spruce	949,000	6,132,000	925,254
Balsam Fir	5,000	382,000	45,864
Jack Pine	91,000	3,065,000	378,495
Other Conifers	--	69,000	8,073
Total Conifers	1,045,000	9,648,000	1,357,686
	Hardwoods		
Aspen and Balsam Poplar	1,608,000	18,301,000	2,090,760
White Birch	22,000	619,000	63,650
Other Hardwoods		170,000	16,150
Total Hardwoods	1,630,000	19,090,000	2,170,560

Total Area

"The tables so far discussed refer only to that part of the province which has been classed as accessible. It is desirable to formulate some conception of the inaccessible parts as well, although it is, of course, impossible to give more than a very general description of them. A fair idea of the nature of these lands is to be obtained from geologists' and surveyors' reports, from aerial photographs, and the accounts of travellers, more particularly those who have flown over the country. The table hereunder shows the probable distribution of the inaccessible lands under the major forest classes, together with the known distribution of the accessible areas. These figures are totalled, and percentage relationships are given for the province as a whole.

TABLE H.- AREA CLASSIFICATION OF MANITOBA
Areas in square miles

Description	Accessible	Inaccessible	Total	Per cent of Total
Water	19,760	7,295	27,055	10.8
Non-forested land	47,103	84,665	131,768	52.3
Non-productive forest	14,791	47,722	62,513	24.8
Productive forest	23,476	7,020	30,496	12.1
Totals	105,130	146,702	251,832	100.0
Per cent...........	41.7	58.3	100.0	.....

"The volume of merchantable timber occurring in the inaccessible forests is believed to be very small, particularly in view of the tremendous area involved. The table below shows the total cordage on the accessible lands in comparison with that estimated to be in the accessible area. It may be that the quantities given for the inaccessible lands are too optimistic, rather than the reverse."

TABLE J.- TOTAL VOLUME (CORDS) OF MERCHANTABLE TIMBER IN MANITOBA

	Accessible	Inaccessible	Total
Conifers	11,604,000	956,000	12,560,000
Hardwoods	22,848,000	622,000	23,470,000
Totals......................	34,452,000	1,578.000	36,030,000

TABLE 1.- DISTRIBUTION OF ACCESSIBLE LAND AREA BY CLASSES OF TENURE
All areas in square miles

District	Class of tenure: Timber licence	Pulp lease	Forest reserve	Vacant crown	Alienated	Total
Assiniboine	--	--	324	1,566	24,400	26,290
Whitemouth	175	--	1,076	2,162	2,115	5,528
Lake Winnipeg East	180	2,290	--	10,857	75	13,402
Lake Winnipeg	295	280	--	5,810	1,695	8,080
Winnipegosis	140	50	--	6.140	2.420	8.750
Mountain	215	--	3,050	510	2,535	6,310
Saskatchewan River	185	--	--	5,940	125	6,250
Upper Nelson	--	--	--	10,705	55	10,760
Totals...	1,190	2,620	4,450	43,690	33,420	85,370

TABLE 2- PERCENTAGE DISTRIBUTION OF CLASSES OF LAND TENURE

District	Class of tenure: Timber licence	Pulp Lease	Forest reserve	Vacant crown	Alien-ated	Total
Assiniboine	--	--	1.24	5.95	92.81	100
Whitemouth	3.17	--	19.46	39.11	38.26	100
Lake Winnipeg East	1.34	17.09	--	81.01	0.56	100
Lake Winnipeg	3.65	3.47	--	71.90	20.98	100
Winnipegosis	1.60	0.57	--	70.17	27.66	100
Mountain	3.41	--	48.34	8.08	40.17	100
Saskatchewan River	2.96	--	--	95.04	2.00	100
Upper Nelson	--	--	--	99.49	0.51	100
Total area	1.39	3.07	5.21	51.18	39.15	100

TABLE K.- DISTRIBUTION OF TOTAL VOLUME OF MERCHANTABLE WOOD ACCORDING TO CLASS OF TENURE

Class of tenure	Conifers: Volume Cords	Per cent of total conifers	Hardwoods: Volume Cords	Per cent of total mixedwood
Timber licence	1,756,000	15.2	1,532,000	6.7
Pulpwood lease	3,657,000	31.5	1,337,000	5.8
Forest reserve	1,533,000	13.2	5,935,000	26.0
Vacant crown	3,900,000	33.6	7,579,000	33.2
Alienated	758,000	6.5	6,465,000	28.3
Totals........	11,604,000	100.0	22,848,000	100.0

"Tables 1 and 2 show the distribution of land area in the accessible portions of the province by classes of land tenure. The distribution of the present merchantable volume among the different kinds of holdings is shown in Table K.

"Table 3 gives the land classification of the accessible areas in detail. It shows the productive forest divided into three main types, each of which is further divided into merchantable areas and three age-classes of young growth. A summary of the productive forest area, showing total area of the main types, and also the total areas of merchantable timber and young growth, is given on the following page.

TABLE L.- PRODUCTIVE FOREST AREA, ACCORDING TO MAIN TYPES AND MERCHANTABLE CONDITION

(Areas are in square miles)

Type	Merchantable	Young growth	Totals	Per cent of productive forest
Softwoods	1,555	5,326	6,881	29.3
Mixedwoods	1,031	4,203	5,234	22.3
Hardwoods	1,542	9,819	11,361	48.4
Totals..........	4,128	19,348	23,476	100.0
Percent of productive forest	17.6	82.4	100.0	--

CLASSIFICATION OF ACCESSIBLE AREAS

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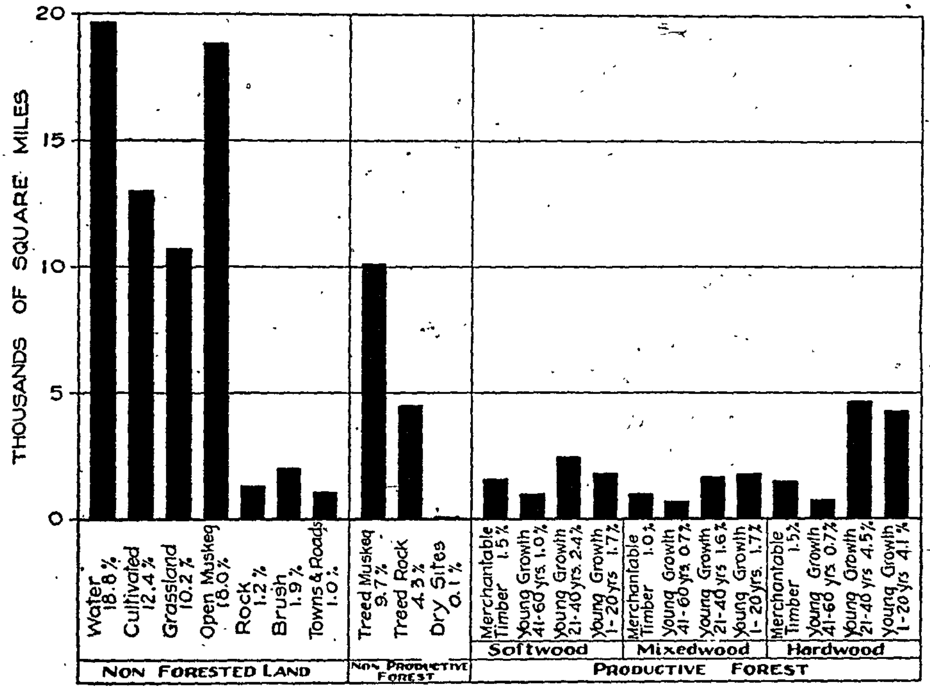

TABLE 3.- SUMMARY CLASSIFICATION OF ACCESSIBLE AREA

Areas are in square miles

Description	Assiniboine	Whitemouth	Lake Winnipeg East	Lake Winnipeg	Winnipegosis	Mountain	Saskatchewan River	Upper Nelson	Totals	Per cent of Total area
	District									
Total area	27,405	5,841	14,319	17,620	12,515	6,495	8,535	12,400	105,130	100.00
Water	1,115	313	917	9,540	3,765	185	2,285	1,640	19,760	18.80
Net land.....	26,290	5,528	13,402	8,080	8,750	6,310	6,250	10,760	85,370	81.20
										Per cent of net land area
Non-Forested										
Cultivated	11,056	320	8	467	395	810	7	--	13,063	15.30
Grass	7,795	373	--	439	1,087	893	91	84	10,762	12.60
Muskeg	717	1,509	4,439	3,420	3,026	218	1,900	3,345	18,874	22.11
Rock	--	16	1,112	1	--	--	102	83	1,314	1.54
Brush	1,218	123	28	91	201	181	59	120	2,021	2.37
Towns and roads	1,069	--	--	--	--	--	--	--	1,069	1.25
Sub-total........	21,855	2,641	5,587	4,418	4,709	2,102	2,159	3,632	47,103	55.17
Non-Productive Forest										
Treed muskeg	19	1,065	1,936	1,587	1,054	261	1,358	2,885	10,165	11.90
Treed rock	--	154	2,807	2	--	--	293	1,288	4,544	5.32
Dry sites	82	--	--	--	--	--	--	--	82	0.10
Sub-total..........	101	1,219	4,743	1,589	1,054	261	1,651	4,173	14,791	17.32

TABLE 3 (cont'd)

SUMMARY CLASSIFICATION OF ACCESSIBLE AREA

Areas in square miles

Productive Forest

Description	Assini-boine	White-mouth	Lake Winni-peg East	Lake Winni-peg	Winni-peg-osis	Mount-ain	Saskatch-ewan River	Upper Nelson	Totals	Per cent of net land area
Softwoods -										
Merchantable	4	308	497	116	139	98	149	244	1,555	1.82
Young growth, 1-20 yrs	13	129	298	280	153	92	469	400	1,834	2.15
" " 21-40 yrs.	5	330	476	216	299	296	548	301	2,471	2.89
" " 41-60 yrs.	-	114	319	132	70	53	208	125	1,021	1.20
Mixedwoods -										
Merchantable	5	152	198	188	77	270	55	86	1,031	1.21
Young growth, 1-20 yrs	6	47	281	127	422	154	251	540	1,828	2.14
" " 21-40 yrs.	18	168	300	190	215	427	176	176	1,670	1.96
" " 41-60 yrs.	-	46	208	37	49	193	87	85	705	0.83
Hardwoods -										
Merchantable	317	164	109	146	309	451	33	13	1,542	1.81
Young growth, 1-20 yrs	1,618	67	85	269	596	689	307	694	4,325	5.07
" " 21-40 yrs.	2,116	120	266	332	592	901	142	263	4,732	5.54
" " 41-60 "	232	23	35	40	66	323	15	28	762	0.89
Sub-total	4,334	1,668	3,072	2,073	2,987	3,947	2,440	2,955	23,476	27.51
Grand Total	--	--	--	--	--	--	--	--	85,370	100.00

TABLE 4 SUMMARY ESTIMATES OF MERCHANTABLE TIMBER

District	White spruce M.Ft.B.M.	White spruce Cords	Black spruce M.Ft.B.M.	Black spruce Cords	Balsam fir Cords
Assiniboine	--	16,000	--	3,000	--
Whitemouth	31,000	10,000	15,000	637,000	79,000
Lake Winnipeg East	28,500	79,000	12,000	1,841,000	148,000
Lake Winnipeg	35,500	60,000	13,000	452,000	49,000
Winnipegosis	52,500	506,000	7,000	410,000	41,000
Mountain	453,500	368,000	54,000	266,000	48,000
Saskatchewan River	56,000	146,000	25,000	248,000	9,000
Upper Nelson	27,000	149,000	--	1,201,000	18,000
Totals	684,000	1,334,000	126,000	5,058,000	392,000
Equivalent in cubic feet of standing timber	149,796,000	156,078,000	27,594,000	591,786,000	45,864,000

District	Jack Pine Cords	Other Conifers Cords	Aspen Cords	Balsam Poplar Cords	White Birch Cords	Other Hardwoods Cords
Assiniboine	--	--	2,374,000	109,000	--	155,000
Whitemouth	743,000	69,000	1,801,000	121,000	24,000	7,000
Lake Winnipeg East	1,395,000	--	1,880,000	184,000	47,000	--
Lake Winnipeg	150,000	--	1,850,000	449,000	45,000	--
Winnipegosis	114,000	--	3,114,000	1,036,000	104,000	--
Mountain	259,000	--	6,261,000	1,732,000	410,000	8,000
Saskatchewan River	135,000	--	465,000	114,000	23,000	--
Upper Nelson	439,000	--	430,000	86,000	17,000	--
Totals.....	3,235,000	69,000	18,175,000	3,833,000	670,000	170,000
Equivalent in cubic feet of standing timber -	378,495,000	8,073,000	1,726,625,000	364,135,000	63,650,000	16,150,000

Total volume of mature standing timber: Conifers, 1,357,686,000 cubic feet (11,604,000 cords); hardwoods, 2,170,560,000 cubic feet (22,848,000 cords).

Note:- For estimate of possible cut of saw material of each species, based on a minimum tree size of 10" D.B.H., see Table G -Page 63.

CHAPTER VI

FUTURE SUPPLIES

"The ability to grow is at once the chief characteristic of the forest, and its greatest point of difference from some other natural resources. The largest mine is eventually worked out, but with due care the productiveness of the forests can be maintained indefinitely; and by the application of proper principles of silviculture it can usually be increased. In Manitoba economic developments have not yet reached the stage where intensive cultural operations in the forest can be profitably undertaken in a general way, and therefore we are concerned for the present mainly with the growth of natural stands.

"The complete investigation of the growth of a forest is a complicated and difficult matter, even where the area concerned is small. The only detailed study of this character which has so far been made in Manitoba was confined to the Mixedwood belt, which corresponds with the Mountain district. The area of this belt is small in comparison with the total area of the province, and the growing conditions in it differ materially from those in other belts. The environmental conditions in the Mixedwood belt are, indeed, the best silviculturally which are to be found, and the rates of growth are correspondingly more rapid than in other districts. Since the superiority of growing conditions in the area which has been studied is apparent, therefore, it would not be reasonable to apply the figures there obtained to the forested areas as a whole, for the results would undoubtedly be too high. As previously stated, in the other districts no complete

studies of growth have been made as yet, although it is expected that such work will be undertaken in the future.

"Even in the absence of complete and authentic information, it is necessary to make at least a preliminary estimate of the increment of the forests, in order that we may have some basis for the discussion of their present situation. Under the circumstances the only course possible is the application of a preliminary calculation based on a consideration of the estimates of area and volume, and a knowledge of the ages at which the different species become mature. Such a method of considering growth is admittedly imperfect, but the results obtained are nevertheless useful, particularly in so far as they are based entirely on the actual quantities of marketable wood which are obtained from existing mature stands.

"The rate of volume growth of a given stand of trees varies greatly with its age. In the first years of its establishment the volume increases slowly, because of the small size of the individual trees. About middle age the growth rate is usually rapid. At maturity the increase in volume per acre practically ceases. On account of this variation in growth with age, it is unwise to attempt to express the growth of a forest as a rate per centum, since a proper understanding of such a rate involves a knowledge of the age of the stand in question, and of several other facts as well. While a percentage rate is subject to misinterpretation, a rate of annual growth expressed as volume increase per unit of area is perfectly definite. Further discussion will, therefore, be confined to growth expressed in terms of volume per acre.

"The inventory project is concerned with present volume of usable wood, and with the volumes which will be available for use in the future. From this point of view, the actual cubic volume of wood material which is found in a young stand is not of interest, until through further growth it reaches merchantable size. While the volume of the young wood does not enter our present calculations, the area which it occupies and its present ages are of the utmost importance. The productive capacity of an area in terms of merchantable volume is indicated by the amount of wood which may be cut when the stand is mature. Division of volume by age gives a rate which is known as the mean annual increment. Since our interest, so far as volume is concerned, is confined to merchantable wood, and since many observations indicate that, on the average, the wood used in this province is cut at about the age of maturity, it is possible to make a preliminary estimate of the productive capacity of the forests on the basis of the average mean annual increment at maturity.

"The extensive areas of young growth will provide the merchantable forests of the future, and the time when these areas will become ready for cutting depends on their present ages. If all age-classes were represented by equal areas, then an equal supply of wood would become merchantable each year, and this quantity could be estimated by multiplying the average volume per acre at maturity by the total acreage of young growth, and subsequently dividing the product by the average age of maturity. Under such ideal circumstances the volume so calculated would represent the permissible rate of annual depletion from all causes, such as fire and cutting. Unfortunately, the distribution of areas of young growth by age-classes falls far short of this ideal".

Growth of Conifers

"Since the conifers supply the great bulk of the wood used in industry in Manitoba, the growth of these species is of the greatest importance. The age of maturity differs to some extent with the different species. Jack Pine and Balsam Fir reach their full growth at an age of between 80 and 90 years. The spruces, on the other hand, become mature at from 100 to 130 years. On the whole, it may be assumed that the average age of maturity of the coniferous species in the province is 100 years. It so happens in Manitoba that the greater part of the wood which is large enough for commercial use is practically mature. This is due to the origin of the presently merchantable stands following a series of fires which occurred between 100 and 120 years ago. At the same time, material between 60 and 90 years old is far from plentiful in the forests.

"The tabulated estimates show the total accessible volume of merchantable conifers to be 1,357,686,000 cubic feet of standing timber, which is the equivalent of 11,604,000 cords. Merchantable conifers are found in two of the main forest types; namely, softwoods and mixedwoods, as shown in Table M.

Table M. - Areas Bearing Merchantable Conifers

Type	Sq.Miles	Equivalent in acres
Softwood	1,555	995,200
Mixedwood	1,031	659,840
Total -	2,586	1,655,040

From the above figures, it follows that the average merchantable volume per acre of mature coniferous wood is 820 cubic feet,

or approximately 7 cords. Since the average age of maturity is 100 years, the rate of mean annual increment is ~~8.2~~ cubic feet or 0.07 cord.

The distribution of young growth among the three recognized age-classes is shown in Table N.

Table N.- Areas Bearing Coniferous Young Growth By Age-Classes.

Type	Age-classes in years: 1 to 20	21 to 40	41 to 60	Total
	Sq.Miles	Sq.Miles	Sq.Miles	Sq.Miles
Softwood	1,834	2,471	1,021	5,326
Mixedwood	1,828	1,670	705	4,203
Total	3,662	4,141	1,726	9,529
Total Acres	2,343,580	2,650,240	1,104,640	6,098,560

"Under ordinary circumstances it might be expected that the average age of an age-class would lie at or near the mid-point of the class, that is, the average age of the 21 to 40 year age-class would be about 30 years, with half of the material involved actually less than thirty years old. In Manitoba this is not the case, as most of the young growth sprang up in the years immediately succeeding periods of great fire damage. The occurrence of these fires will be discussed in the chapter on Depletion, but their effects on the age of young growth must be mentioned here. Almost two-thirds of the young growth originated after a period of fires of exceptional severity which extended from 1885 to 1896. Therefore, the average age of the 21 to 40 year age-class lies between 35 and 40 years, while that of the 41 to 60 year age-class is about 45 years, with very little young growth as old as 50 years. There are some scattered stands between the ages of 60 and 90 years, but


D

their aggregate area is very small. The following table, based on the use of 7 cords per acre as the measure of the productive capacity of the average acre, and an age at maturity of 100 years, shows the effects of the present poor distribution of age-classes on the supplies of the future:-

Table 0.- Estimated Quantities of Wood Available from Manitoba Forests at Specified Future Dates

Age-Class	Date of Maturity	Volume at Maturity
		cords
41 to 60 years	A.D. 1982 to 1991	7,730,000
21 to 40 years	1992 to 1997	18,550,000
1 to 20 years	2012 to 2032	16,410,000

"This table is given only for the purpose of illustrating what growth alone can be expected to accomplish under natural conditions. It must not be regarded as a prophecy of what will actually happen, since it makes no allowance for the destruction of some of the young-growth areas by fire or other causes, which will certainly take place.

"It will be noted that a large amount of wood can become mature through growth, commencing at the year 1982, or fifty years in the future. In the meantime, there will be an ever increasing tendency to cut wood which may be of merchantable size, although somewhat on the small side, before it is mature. This practice is obviously a very bad one, as it does not permit the fullest use to be made of the productive power of the soil."

Assuming that the young age classes will yield at maturity at the same rate as the present merchantable stands and that the current volume increment on the whole productive forest area of all ages is equal to the mean annual increment of the stands at present merchantable, it is possible to arrive at a figure for mean annual increment

at maturity as follows:-

Softwoods - 50,000,000 cubic feet per year.

This method of calculating volume increment is correct only if the age class distribution is normal.

The actual annual increment at the present time will be somewhat higher than the mean annual increment at maturity, due to the fact that the 40-50 year age class is so predominant, and that this age class grows at a faster rate than the mean annual increment. This figure of actual annual increment at the present time is of only academic interest as, of course, timber does not become available for use until it is mature.

Bulletin 85, "The Forests of Manitoba" sets the permissible depletion at 41,000,000 cubic feet, which is considerably less than the mean annual increment. The reason given for this is the necessity of spreading the cut of merchantable timber over a period long enough to allow the next age class to become mature. This figure of 41,000,000 cubic feet is accepted at the present time for the Permissible Depletion of softwood.

GROWTH OF HARDWOODS

" Discussion of the growth of hardwoods may be restricted to the two species, Aspen and Balsam Poplar, since the other hardwoods are widely scattered in their occurrence and represent only small volumes of wood. The growth of the poplars in turn has two quite different aspects, depending on location. Under average conditions an acre of poplar will yield about fifteen cords of wood at an age of 70 years, which indicates a rate of mean annual increment at maturity of o.21 cord per acre, or just three times the rate of growth of the conifers.

"In the Assiniboine district poplar furnishes the principal fuel supply for the rural population. The consumption for the district cannot be determined with accuracy, but it is probably about 350,000 cords per year. The total area of hardwood and mixed forest in the district is 4,312 square miles (2,759,680 acres), including stands now merchantable and young growth. With a mean annual increment at maturity of 0.21 cord per acre, the possible production under natural conditions is about 580,000 cords per year. On account of unfavourable distribution of age-classes much material is cut before it is mature, and the actual rate of production is thereby lowered. It seems probable that under existing conditions there is no great excess of supply over demand; but if the easily accessible groves of Aspen occurring on farm woodlots were put under any degree of management the supply could undoubtedly be increased."

In the other districts the supply of poplar is so vastly in excess of demand that an attempt to estimate the existing rate of growth of the species has very little point. The actual estimate is 220,000,000 cubic feet per year.

Attention must again be directed to the preliminary and empirical character of the estimates given in this chapter. At the same time it is felt that, though they may be imperfect, they at least form a working basis for the formulation of forest policy in the immediate future."

CHAPTER VII

DEPLETION

The depletion of the forest resources may be considered under the headings of Fire Loss and Utilization, the first of which is one of the elements of Waste, while the second is one of the economic justifications for the carrying on of Forestry.

The two other elements of Waste, namely, that caused by insect pests and by fungi cannot be used in making up a summary showing the balance between Increment and Depletion. "Both of these causes have two quite different aspects, which may be described as epidemic and endemic. The last-mentioned activities of insects and fungi are part of the normal life of the forest, and are constantly going on, nor are their activities all to be considered as harmful in the long run. Attention has already been drawn to the reduction of number of trees per acre which occurs with increasing age of a stand. Since the trees which are crowded out cannot be salvaged under natural conditions, it is desirable that they should be put out of the way of the stronger individuals as soon as possible. The death of the weaker trees is hastened by those insects which attack only trees of reduced vigour, and their decay is furthered by the action of fungi. Since these trees had to die in any case, the action of the so-called pests may be beneficial to the stand as a whole. In the same way, these agencies hasten the disappearance of trees which have become over-mature, and make the room which they occupied available for younger and more rapid growth. These facts are mentioned here in order that they may be compared with statements

which have sometimes been made, to the effect that the actual losses to the forest from insects and fungi are as great as those from forest fires. Such statements should be considered as referring only to the epidemic activities of these pests. So far as their endemic activities are concerned it has been explained that in themselves they cause little or no loss, and it is certain that in Manitoba they have not caused any known damage which can be compared with that due to fire."

Epidemic outbreaks of insects or fungi, on the other hand, may do very great damage to healthy, growing timber. Examples of these outbreaks are given under another section in this report. Losses from these causes will have to be taken into calculation if and when they occur, as they are entirely unpredictable.

Depletion in the hardwoods, either from Fire Loss or by Utilization, is quite small compared with the Annual Increment. In arriving at a balance between Increment and Depletion, it is essential to consider the Softwoods on their own merits, as they supply certain classes of essential material for which the Hardwoods are not suited. The proper handling of our resources of Softwoods offer us a problem in conservation both on account of their being particularly liable to fire loss and also in great demand for industry. With reference to Hardwoods, on the other hand, the main problem is that of encouraging the utilization of what is now largely going to waste. For this reason all the tables following refer only to Softwoods.

The figures include depletion of timber on private lands as well as on provincial Crown Lands and Forest Reserves, but depletion on the Riding Mountain National Park has not been in-

DEPLETION OF FORESTS

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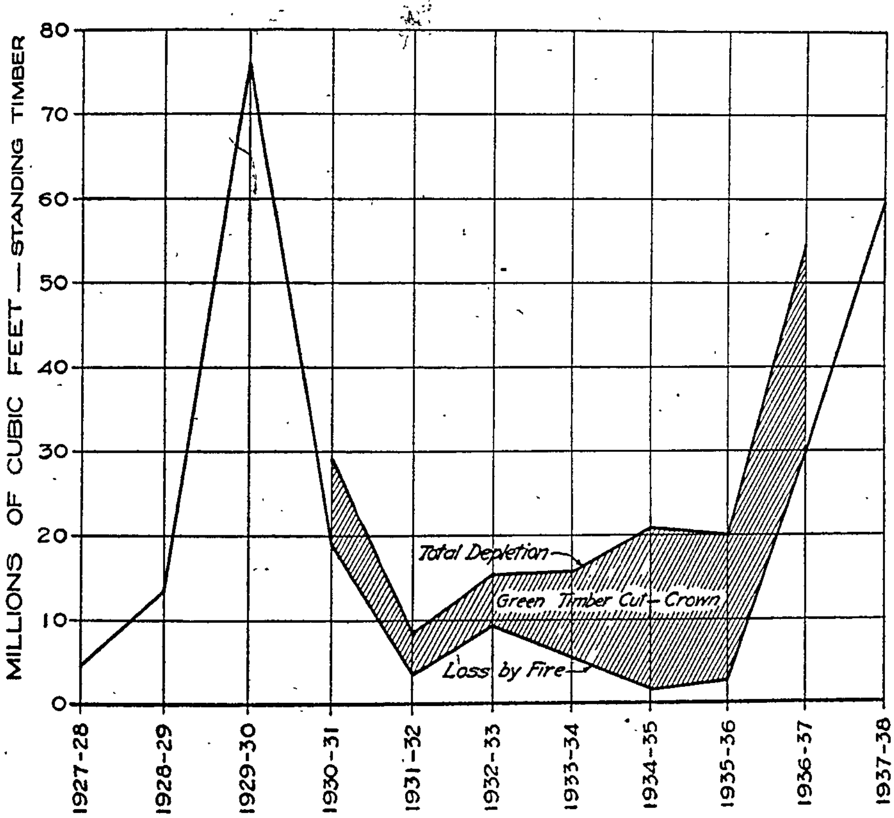


cluded, complete figures not being available at the present time.

Fire Losses

Fire losses are carefully tabulated, estimates being made of the merchantable timber and young growth burned by each fire. Merchantable timber losses are calculated both in volume of wood and acres burned, while young growth is estimated in acres burned.

The annual fire loss varies enormously and the setting of an average figure is difficult. The Dominion Inventory sets the average fire loss at the following:-

Softwoods	-	18,500,000 cubic feet
Hardwoods	-	2,000,000 cubic feet
Total	-	20,500,000 cubic feet

These figures were arrived at by taking 75 per cent of the average fire loss for the years 1927-31 inclusive. It is probable that in this average too much weight was given to the losses incurred in 1929, which was about the worst year in 45 years.

It is considered preferable to use the average of the years 1930 to the present time, and to carry this average on from year to year, making no deductions. These years were probably drier than the average, but a few wet years will correct this error. The use of the period dating from the time of the transfer of the natural resources has an advantage in that since that time careful records of the other item of Depletion, namely, Utilization, have been kept. The losses which were originally tabulated as Ft. B.M. for the larger material and as cords for the smaller timber, have been converted into cubic feet of standing timber in both cases so that the totals may be brought together. For convenience in calculation one cord is considered to be equivalent to 100 cubic feet, while

1,000 Ft. B.M. is considered to be equal to 200 cubic feet.

The following table shows the fire losses by years, the totals and the average yearly loss from 1930 to 1936 inclusive. The 1937 must be omitted on account of the comparable figures for the utilization of that year, (1937-38) not being yet available.

Table used for determining average Fire Losses to Softwoods in Cubic Feet of Standing Timber

Year	Fire Losses
1930 - 1	16,700,000 cubic feet
1931 - 2	3,200,000 " "
1932 - 3	8,600,000 " "
1933 - 4	5,300,000 " "
1934 - 5	1,700,000 " "
1935 - 6	2,100,000 " "
1936 - 7	26,600,000 " "
Total -	64,200,000 cubic feet
Average -	9,200,000 " "

Utilization

"The annual rate of utilization was radically altered by the opening up of the pulpwood market, caused by the establishment of a pulp and paper mill in the province in 1926. The new market was flooded by a serious overcut in the next two years, and this in turn was followed by an undercut of all forest products, due to the general economic depression which began to be severely felt in 1930."

The fiscal year 1931-32 had the lowest forest utilization of any year since the Great War, one of the main factors in this curtailment being the closing of Manitoba's paper mill in March 1932. This mill did not re-open until July 8, 1935, but there was an increase of cut in products other than pulpwood starting with the fiscal year 1932-33, and increasing year by year until the present

time. The paper mill re-opened in July, 1935, and during the calendar year 1937 registered its greatest production. About the end of 1937 there was a curtailment of production of paper, which may or may not be temporary. Production of lumber, railway ties, etc., is still at a relatively high figure, and on the whole the fiscal year 1937-38 will register a record production of timber.

The Forest Service have kept records since the transfer of the natural resources, showing the utilization by fiscal years both for Government and private lands. The cut from Government lands is from actual returns, while the cut from private lands is more in the nature of an estimate, being based partly on census returns, partly on railway shipments, and partly on general observations. As far as the cut of softwoods go it is reasonably accurate, this being the class of wood of most importance.

The intention is to use the statistics of utilization of forest products from the fiscal year 1930-31 to the present time in order to arrive at an average annual utilization. This gives us figures for seven years up to the present time. It is, of course, apparent that the longer the record is carried on, the closer the average will be to the true normal.

In order to make all products comparable it has been necessary to convert everything to the common unit of cubic feet of standing timber. In all cases the converting factors used by the Bureau of Statistics were used.

Table used for determining the average Utilization of Green Softwoods in Cu.Ft. of Standing Timber.

Year	Utilization
1930 - 1	12,000,000 cubic feet
1931 - 2	4,900,000 " "
1932 - 3	6,500,000 " "
1933 - 4	9,300,000 " "
1934 - 5	19,200,000 " "
1935 - 6	19,100,000 " "
1936 - 7	26,400,000 " "
Total -	97,400,000 cubic feet
Average -	13,900,000 " "

Utilization of dry, fire-killed timber is not included in the above, for the reason that volumes of this class of material are already included under the heading of Fire Losses. The amount of such material salvaged from Crown Lands during the year 1936-37 was 6,100,000 cubic feet, this including both softwoods and hardwoods.

CHAPTER VIII

FOREST PROTECTION

FIRE PROTECTION

Manitoba's forests are subject to the highest fire hazard in Canada. They are bordered on the south and west by grasslands and have large grassy marshes interspersed throughout the wooded areas. In the northern and north-western parts of the province they are bordered by the practically unprotected wilds of Ontario and Saskatchewan.

Manitoba has a comparatively low percipitation and, failing an even distribution of rainfall during the summer months, is subject to short periods of high fire hazard in one or more parts of the province. During major drought periods, one of which we have just passed through, the forests, like the field crops, suffered heavy losses.

During exceptionally dry periods such as have occurred during the last ten years, muskegs, which cover large areas have been one of our worst fire problems; these dry out to a depth of 8 or 10 feet, or more, and fire will burn down to moisture. It is impossible to completely extinguish such fires and they sometimes burn for a year or more. Again, the top of a dried out muskeg is as inflamable as powder and fire will run over them at an incredible speed, scattering fire in all directions.

Manitoba is subject to high continental winds which sweep in from the open plains to the south and west and make fire fighting during such periods most difficult. The fire hazard has been further

increased in recent years by the influx of prospectors, trappers and others into our northern areas, the aeroplane giving easy access to portions of the province formerly considered inaccessible.

The history of forest and prairie fires can be traced back for more than a hundred years by examining the diaries of the early fur traders and explorers, and also to some extent by the study of existing forests and remains of those trees destroyed at different periods by fire. We find that until the land was settled and broken up and roads constructed, prairie fires were of common occurrence and they continually burned back and killed the forests, preventing their extension southward and westward and this to a large extent is the reason why we have the open prairie lands. Since the establishment of settlement and the building of roads, prairie fires seldom occur and the forest is now advancing both south and west into the open plains.

Fire Protection Methods

Fire protection is divided under three headings:- (a) Prevention, (b) Detection, and (c) Suppression.

Prevention of forest fires means educating the public to exercise care in wooded areas while using camp fires, matches or smoking material; in securing their co-operation in extinguishing small outbreaks and in notifying forest rangers immediately any fire occurs.

Fire prevention also includes the removal of brush or any other inflammable material adjoining or in the forest, seeing that locomotives and other steam engines are provided with proper spark arresters and that long grass, etc., is cleared from railway rights-of-way.

Detection

It is absolutely necessary to detect fires in their incipient stage and rush fire fighting crews to the scene and suppress them. Normally it is quite easy to extinguish a fire when it is not more than a few acres in extent. When, however, delay occurs in locating fires and they reach large size, suppression work becomes very difficult and of course much more costly. For this reason every means is used to detect fires quickly and forward the information to headquarters of the fire district where fire fighting crews and equipment are assembled.

Where possible observation towers, either of wood or steel, are erected on high points of land and connected by telephone or telegraph with a central station and if possible communication is established between towers covering the same general area. An instrument for taking the bearing of fires is placed on each tower and the point of intersection of these bearings from two or more towers accurately locates the position of such fire. As a rule most of the fires in a large part of the northern area, where no means of communication exist, are spotted from aeroplanes, either of our own service or by some of the commercial air services who co-operate with us in this way and are of great assistance.

More towers should be erected when money becomes available and all towers should be linked up by telephone, telegraph or radio.

Suppression

In fighting forest fires, the speed with which fire crews and equipment can be rushed to the scene of the fire always determines whether the fire will be easily extinguished or whether it will reach large dimensions, destroy much valuable timber and cost a lot of money to control. In this respect forest fires and fires in towns and cities are similar. It is therefore necessary that properly organized fire crews with the best procurable equipment, and this includes tents, bedding and food, as well as fire fighting tools, be rushed to a fire with a minimum of delay by the fastest means possible.

In the southern part of the province and in most of the forest reserves, crews and equipment are moved by motor truck, or teams and wagons, and in some cases by railway gas cars. In the north, crews are usually flown in by plane to the nearest safe landing point. Canoes have been cached at many of these landing areas, and the fire fighters may continue on to the fires in these. In other cases large freight canoes are lashed under the fuselage of the larger planes and flown in with the fire crews.

The use of seaplanes in fire fighting in the northern areas has proved entirely successful. It is the only possible way in which crews can be taken to fires quickly enough to be of any use. There are no roads or trails in this huge area, and the only method of travel in summer, other than by plane, is by canoe. In many cases it would take a week or more for a canoe party to ascend some of the rivers, while a plane could fly the same distance in half an hour. A fire protection organization depending on canoes alone is

useless and, in the end, many times more expensive than if planes were used. They have seldom been of any use in extinguishing distant fires.

Crews for fire fighting in the north are picked up by plane from small settlements, Indian reserves or from mining settlements scattered throughout the area, and as they are usually experienced woodsmen make excellent fire fighters.

While our fire fighting organization covers the whole of the timbered area of the province, a greater measure of protection is given the more valuable stands of timber in accessible areas.

While there are many causes, human carelessness or indifference is responsible for the majority of forest fires. Trappers in the north usually light their camp fires during the winter in dense stands of spruce in the muskegs to be protected from the winds. These fires may burn deeply into the moss and peat and smoulder for months, flaring up during dry periods in the summer and causing serious fires. In the more settled districts summer camp fires and fires allowed to spread while clearing land, are responsible for many outbreaks.

The following tables give the causes and the monthly distribution of fires since the transfer of the natural resources, averaged over that period.

AVERAGE YEARLY CAUSE OF FIRES 1930-37

Causes	Average No. of Fires	Percentage
Camp Fires	76	22
Smokers	47	14
Settlers	51	15
Railways	23	7
Lightning	60	18
Industrial Operations	7	2
Incendiary	52	15
Public Works	9	3
Unknown	11	3
Unclassified	4	1
Total	340	100

AVERAGE MONTHLY DISTRIBUTION OF FIRES
1930 - 1937

Month	Average No. of Fires	Percentage
April	13	4
May	99	29
June	45	13
July	67	20
August	84	25
September	24	7
October	8	2
Total	340	100

During the major drought period through which we have just passed, it was to be expected that losses from forest fires would be extensive. The fire fighting organization of the Forest Service, while able to cope successfully with fires during period of normal precipitation and keep losses within reasonable limits, was unable to properly control the situation during this major drought period, owing to the impossibility of securing the services of sufficient well trained men to handle fire fighting crews. The result was, of course, that losses were sometimes heavy.

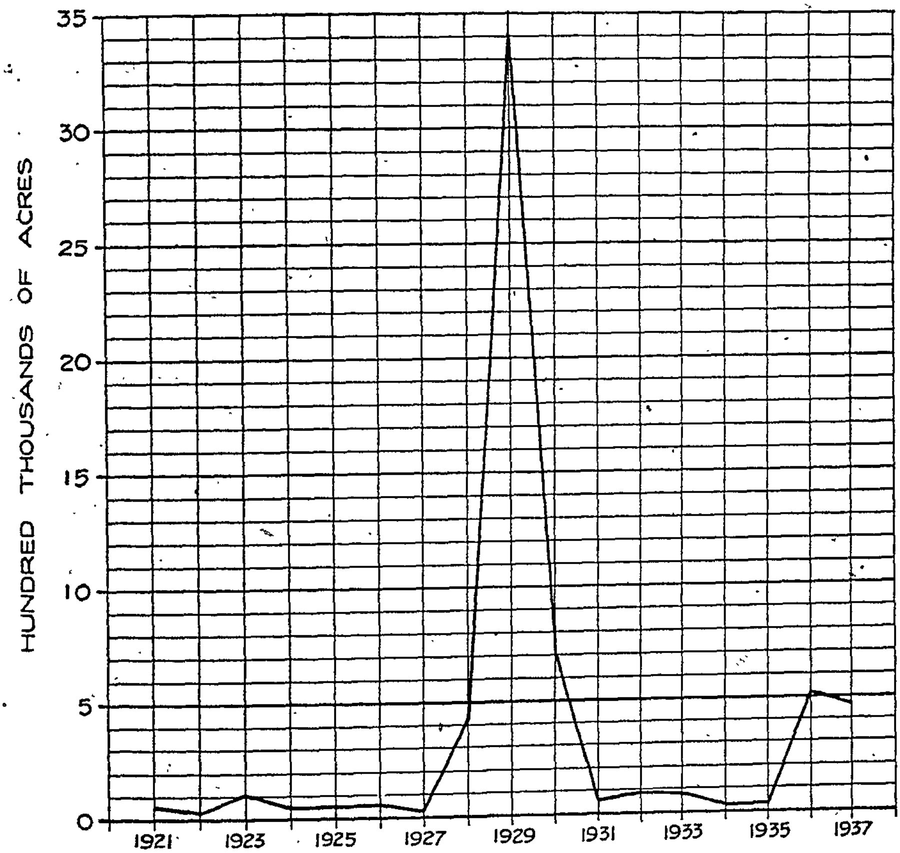
The following table shows the area burned and loss of timber each year since the transfer of the resources to the province:-

AREA BURNED IN ACRES 1930-1937

Year	Merchantable & Partially Cut-over Timber	Young Growth	Not Forested	Total Area
1930	96,092	101,216	505,344	702,652
1931	9,907	12,119	34,041	56,068
1932	27,358	34,142	27,262	88,762
1933	11,944	20,195	41,919	74,058
1934	5,160	11,140	73,563	89,863
1935	3,051	12,209	15,277	30,537
1936	68,657	34,817	417,151	520,625
1937	76,834	67,230	319,818	463,882
Total	299,003	293,068	1,434,375	2,036,447
Average	37,375	36,663	179,297	254,556

FOREST DEPLETION BY FIRE

MANITOBA



TIMBER BURNED 1930-37

Year	Saw Timber F.B.M.	Additional Timber Cords	Total Damage $
1930	626,000	206,350	271,485.30
1931	555,000	34,334	31,872.80
1932	2,965,000	90,000	95,487,95
1933	1,330,000	56,032	81,650.79
1934	128,000	18,669	34,897.80
1935	416,000	22,489	20,515,75
1936	950,000	293,973	187,565.97
1937	5,561,000	585,305	266,902.75
Total	12,531,000	1,307,152	990,379.11
Average	1,566,375	163,394	123,797.39

The figures for total damage include depreciation on salvable timber, loss of unsalvable timber, loss of young growth and loss of other property.

The figures include all timber burned, whether salvable or not.

Insect Damage

It is impossible to estimate with any degree of accuracy the volume of timber destroyed by insect infestations, but losses from this cause probably greatly exceed those caused by forest fires. Tentative estimates for the whole of Canada place the loss caused by insects and from fungi at 700 million cubic feet of standing timber annually, while the average yearly loss from forest fires was only 267 million feet of merchantable timber.

Several notable infestations of insects causing immense damage to timber have occurred since the beginning of the century. The European larch saw-fly, a defoliator, starting in eastern Canada, reached Manitoba about twenty-five or thirty years ago, and continued onward to Alberta. This outbreak destroyed practically all the

mature tamarack or larch from central Alberta to the eastern seaboard.

Ten or fifteen years ago an outbreak of spruce budworm in eastern Quebec, New Brunswick and Nova Scotia destroyed over 400 million cords of spruce and balsam before subsiding.

At the present time a yet unchecked infestation of a newly introduced defoliator, the spruce saw-fly, is doing great damage to the spruce forest in the Gaspe peninsula, eastern Quebec and already thousands of square miles of valuable timber have been destroyed.

In Manitoba in 1924 a small infestation of the spruce budworm was observed on Little Moose Island, and on the western shore of Lake Winnipeg, but only a few square miles of timber were destroyed. For some unknown reason this outbreak did not persist but died out the following year. Had a trained entomologist been available, valuable information as to the agency responsible for the suppression of this outbreak, might have been secured.

In 1935 a severe outbreak of spruce budworm working entirely on jack pine, killed or permanently injured large areas of these trees in eastern Manitoba and western Ontario. Examination during 1937 by Dominion entomologists showed that this outbreak is now on the wane, probably owing to climatic conditions or the development of local parasites.

In addition to the many defoliating insects, which may cause extensive damage to our forests, if uncontrolled, there are many species of bark beetles which ordinarily attack weakened or dying trees. They may, however, increase enormously under favourable conditions and spread to healthy trees, causing heavy damage.

In the case of defoliating insects, the introduction of large numbers of suitable parasites into an infested area seems to be the only possible method of control which can be successfully used in our forests, although spraying in small areas might be possible. Suitable parasites are imported from Europe. They are multiplied rapidly in laboratories and released sometimes in millions in affected areas.

In the case of bark beetles it may be possible to introduce parasitic control, but silvicultural methods are generally employed. Infected trees are removed and burned before the swarming period. In some cases decoy trees are prepared by girdling and cut down and burned when they become heavily infested.

Insect infestations which might be easily controlled if recognized in the incipient stage are, of course, much more difficult when spread over large areas. To identify the destructive species requires the services of a trained forest entomologist. Fortunately the Minister of the Department of Mines and Natural Resources arranged with the Dominion government for a highly trained forest entomologist to be permanently stationed in Manitoba, and it is expected that an entomological laboratory will shortly be established in Winnipeg.

Fungi

Fungi which cause rot in trees are responsible for very heavy losses in our forests. It is, of course, impossible to estimate with any degree of accuracy the value of wood destroyed, but it is safe to say that loss from fungous diseases greatly exceed that resulting from forest fires.

Fungous disease is spread by wind borne spores. Millions of spores are disseminated from a single fruiting body and as they are

slightly sticky they adhere to any object with which they come in contact. Any wound in any part of a tree such as a crack or broken branch on which a spore may find lodgement, is likely to start infection.

Fungi usually attack injured, weakened or over-mature trees, but logs, tops of trees and branches if left in the woods after logging, provide a suitable habitat for the rapid increase and spread of this disease.

Until further study of fungi is made by forest pathologists we must control this disease by removing where possible, all over-mature, injured or dead trees and by burning all brush and other debris resulting from logging operations. This of course is being done in Manitoba and we are the only province in Canada insisting on clearing up the forest in this manner. Also, wherever it is possible to do so, we insist on all dead or dying trees being removed from an area before permitting green healthy timber to be cut.

The silvicultural control of diseases caused by fungi, such as the red stain and red rot in jack pine, is an established method which calls for a reduction in the cutting rotation of this species, so as to remove the trees before the disease has done any damage. This practice might eventually eliminate the occurrence of the fungus, by destroying it before it can arrive at the stage where fruiting bodies for the dissemination of spores are produced.

When it can be arranged, specially trained forest pathologists should be employed to make a thorough study of this subject. It might be possible to greatly reduce the heavy losses from this cause.

CHAPTER IX

THE GENERAL SITUATION

Summary of Timber Situation

"Of a total area of 251,832 square miles, 58.3 per cent of the province of Manitoba is inaccessible to commercial forest operations. Of the 105,130 square miles which are accessible (constituting 41.7 per cent of the total area) the area distribution is as follows:-

Classification of Accessible Areas of Manitoba

Classification	Area in square miles	Per cent of accessible area
Water	19,760	18.8
Non-forested land	47,103	44.8
Non-productive forest	14,791	14.1
Productive forest	23,476	22.3
Totals -	105,130	100.0

"The accessible volume of merchantable timber is 3,528,246,000 cubic feet of standing timber (34,452,000 cords), of which one-third is coniferous; the remaining two-thirds is composed of hardwoods.

"The relation of supply to demand in the case of the conifers differs radically from that of the hardwoods. The situations of the two groups will, therefore, be summarized separately.

Conifers:

Areas Bearing Conifers

Age-Class	Type			Per Cent
	Softwood	Mixedwood	Total	
	Sq.miles	Sq.miles	Sq.miles	
Merchantable	1,555	1,031	2,586	21.3
Young growth 1-20 yrs	1,834	1,828	3,662	30.2
" " 21-40 "	2,471	1,670	4,141	34.2
" " 41-60 "	1,021	705	1,726	14.3
Totals	6,881	5,234	12,115	100.0

The present merchantable area is slightly more than one-fifth of the total area producing conifers. The average age of the 21 to 40 year age-class is about 38 years, and that of the 41 to 60 year age-class is 45 years. The representation of ages between 60 to 90 years in the merchantable group is abnormally poor."

For the period of seven years, including the fiscal years 1930-31 to 1936-37, it is estimated that on the average forty-four square miles of merchantable lands and fifty square miles of young growth was burned over.

The table shows the present merchantable volume and the permissible rate of depletion as compared with the present average rate.

Balance Sheet for Softwoods

		Cu.Ft. of standing Timber	Equivalent in Cords
Merchantable Volume		1,357,686,000	11,604,000
Permissible rate of Depletion		41,000,000	350,000
Actual Rate of Depletion			
Utilization	- 13,900,000		
Fire Loss	- 9,200,000	23,100,000	231,000
		17,900,000	119,000

In order that a continual check may be kept on the general timber situation the figures in the above table are to be revised yearly, giving a new average each year for the two elements of Depletion and consequently a revised annual balance.

"The relative importance of the different coniferous species with respect to available volume, utilization, and waste are shown

in the following table:-

Percentage Distribution of Conifers, by Species

Species	Merchantable volume	Normal utilization	Normal Waste (fire)
White and Black spruce	68.1	64.1	56.7
Balsam Fir	3.4	0.3	1.1
Jack Pine	27.9	31.6	42.2
Others	0.6	4.0	-
Totals	100.0	100.0	100.0

Hardwoods

"The relation of visible and future supplies of hardwoods to the rate of depletion is not gone into as fully as in the case of conifers, since it is known that in the accessible forests, as a whole, the supply vastly exceeds the demand.

Areas Bearing Hardwoods

Age-class	Type			
	Hardwood	Mixedwoods	Total	Per cent of total area
	Sq.miles	Sq.miles	Sq.miles	
Merchantable	1,542	1,031	2,573	15.5
Young growth 1to20 yrs	4,325	1,828	6,153	37.1
" " 21 to40 "	4,732	1,670	6,402	38.6
" " 41 to60 "	762	705	1,467	8.8
Totals	11,361	5,234	16,595	100.0

"The estimated merchantable volume at the present time is 2,170,560,000 cubic feet, or 22,848,000 cords, about twice the volume of the merchantable conifers. At the same time the upper age-classes of young growth are much closer to maturity than the corresponding classes of conifers, since the poplars, which compose 96 per cent of the stands, are full-grown at about 70 years.

"The normal rate of depletion is 39,220,000 cubic feet (413,000 cords) per year. In the case of the Assiniboine district

the demand for hardwoods for fuel may approach the available supply, but for the rest of the province the problem of the hardwoods is not one of conservation so much as one of discovering new means of utilization."

Depletion and Growth

"From the information presented it is apparent that for the coming fifty years the principal dependence for supplies of merchantable coniferous timber must be placed on the areas which are now bearing wood of marketable dimensions. Relatively little new wood will become available during that time on the areas now classed as young growth, because of the poor distribution of age-classes. Given protection from damage for the next fifty years, the forests of the province will then be of far greater value than at present."

While the actual depletion of the forest at the present time has been shown to be considerably less than the permissible depletion the situation is not entirely satisfactory. In the first place fires are annually burning large quantities of timber which should be available for industry. Fires are also eating into our young growth areas from which our future cut is supposed to come. The burning of areas of fifty year old young growth for example throws this area back into the zero age-class, assuming that regeneration takes place at all. We have considerable hope of being able to increase our annual cut when the young growth which is now about fifty years old becomes mature, but in order to do this it will be necessary to improve on our fire protection.

The demands of industry for timber are increasing, for example the cut of the y ar 1937-38 (while figures are not complete),

will certainly be the largest since before the Great War. Areas closest to transportation routes are naturally cut over first, forcing later cutting to be done further back. The development of truck and tractor hauling has fortunately enabled operators to go back much further than they could have in earlier years. There is, of course, a limit to the distance timber can be hauled economically, even with the most efficient of equipment. Eventually there will be a natural restriction of cut due to the excessive cost of hauling.

Summary by Districts

The above summary refers to the balance of Growth over Depletion in the Accessible Area of the province as a whole. It is now necessary to discuss this balance for individual districts of the province.

It is obvious that the depletion of timber in any district should not exceed the Growth, except in the cases where there is a disproportionally large percentage of the forest included in the mature and overmature age classes. Again, in a new country there are certain districts which have to be cleared of timber in order to develop them agriculturally, although even here a proportion of each farm should be left forested. The final decision as to what districts should be reserved for forest and what should be opened for agriculture should be decided by a scientific land classification. The decision in the past has been made in a rough and ready way, the real farmers usually going to land suitable for agriculture. On the other hand those who have been principally interested in work in the bush, hunting, trapping or fishing have procured land in the forest, a great deal of which should

never have passed out of the hands of the government.

It is the policy of the Department to eventually divide each forested district into Working Plan Units, and to handle each of these units on a Sustained Yield basis. To do this it is necessary for the Department to have full control of the land and also to have the land permanently dedicated to forest production. Progress can be made along this line only when this classification and dedication has been done.

A description of the Inventory Districts as outlined in Bulletin 85, see map, is included in a later section of this report. These districts are much too large to be used as units for a Working Plan, and it is necessary to subdivide these into smaller areas such as watersheds, districts tributary to certain railway lines, or in some cases Forest Reserves or Ranger Districts.

A brief reference is made below as to the general situation in certain of the Inventory Districts, (see map, opposite page 52.)

The Assiniboine District is largely agricultural. The only responsibility of the Forest Service here is the proper management of the Turtle Mountain and the Spruce Woods, and the encouragement of the establishment or maintenance of farm woodlots. Each of these subjects has been discussed above.

The Whitemouth district is the only one of the seven purely forest districts which is in any danger of overcutting. The greater part of the whole district is suited only for forestry. The two Forest Reserves, the Sandilands and the Whiteshell are being carefully safe-guarded against overcutting. The bulk of the area outside the Reserves should also be set aside in the same way.

A review of the situation in this district was made about a year ago. It was found that there had been definitely an undercut of the hardwoods. In the case of Jack pine the situation was favorable on the whole, except that it was necessary to prohibit cutting in certain areas close to the highways and railroads, both to protect these areas and also to encourage the cutting of mature timber further back. In the case of spruce there appeared to have been in the past a definite overcut for the district as a whole. This is to be explained by the proximity of the Whitemouth District to the pulp mills of Manitoba, Western Ontario and the United States, the number of railways and highways through the District and the fact that it lies near the large Winnipeg lumber market. The greatest cut took place in the years of the pulpwood boom, 1926-30.

It should be made clear that a great deal of the unfavorable balance was due to cutting on private lands over which the Department had no control, a great deal of which lands should be Forest Reserves. In order to do whatever could be done on Government lands outside the Forest Reserves, with the present set-up, a preliminary field examination was made of certain townships close to the railways and highways. As a result of this examination about twenty-four townships were closed to cutting of all softwoods or in some cases of certain species and products.

District No.3, the Lake Winnipeg East, is entirely unsuited for agriculture except for certain areas along the Winnipeg River. The ~~main problem here is fire protection~~ and the development of markets for material now going to waste through inaccessibility.

Districts No. 4 and 5, the Lake Winnipeg West, and the Winnipegosis District, respectively, are agricultural along their southern limits, but run north into an undefined area of land which should be reserved for forest. The area around Lake Winnipegosis particularly is very valuable for timber production, has some very extensive stands and is quite accessible by water.

District 6, the Mountain District, is one of the most important from a forestry viewpoint. Fortunately practically all the true forest land is in Forest Reserves or the National Park. A working plan for spruce is in operation at the Duck Mountain and will be extended, when conditions allow, to other species and other areas.

Districts No. 7 and 8, the Saskatchewan and Nelson River Districts, have had very little production, except a little along the Hudson Bay railway and the Flin Flon subdivision. The Departmental policy is to encourage increased utilization in these districts and to keep up an efficient fire protective system.

CHAPTER X

DETAIL OF FOREST DISTRICTS

THE ASSINIBOINE DISTRICT

"Area

The Assiniboine District has an area of 27,405 miles, of which 1,115 square miles are occupied by water. Two forest reserves, the Turtle Mountain and the Spruce Woods, lie in this district.

"Description

It includes both the Grassland and Aspen Grove belts. The area is almost exclusively devoted to agriculture, with grain-growing as its principal activity. The relative density of the rural population is much greater than it is in the rest of the province. The importance of the forests is very small when compared with that of the farm lands, since the predominant tree growth consists of scattered groves of aspen. At the same time, the easily accessible supply of fuel to be obtained from these groves is of great local importance.

"Lying at the south of the province, the district enjoys a climate somewhat less rigorous than that of other parts, but it is none the less subject to extreme variations of temperature. Winter minima as low as -40 degrees Fahrenheit are not uncommon, while the hottest days in summer may reach 100 degrees F. The precipitation averages 17 inches per annum, most of which falls in summer as rain. The rate of evaporation is high, particularly in that part of the district lying in the Grassland belt. The length of the growing season varies considerably in different localities. At the international boundary it averages 160 days, at the northern extremity of the area about 130 days.

[illegible]

"The eastern part of the district is in the first prairie level, which rises through the Pembina hills to the second prairie level farther west. The topography is level or gently rolling, with the exception of a few low eminences, which include the Brandon and Tiger hills. Drainage is for the most part very good. Swamps of some size are to be found in the vicinity of Lake Manitoba, but elsewhere they are of comparatively rare occurrence. The principal rivers are the Red and the Assiniboine, the former of which flows north to Lake Winnipeg, while the Assiniboine flows eastward to join the Red at Winnipeg.

"Without exception the subsoils are of glacial origin. The valley of the Red river and the majority of the lands lying to the west of it were for a long time at the bottoms of Lakes Agassiz and Souris. The drift is overlain by silt and thus enriched, so that the soil is now extremely fertile. A series of low sand dunes, extending from the Spruce Woods forest reserve northwards to the town of Neepawa, was formed by wind action from an old delta of the Assiniboine river. Elsewhere the glacial material has been relatively little modified, yet it offers good farming soils varying from clay loams to sandy loams. The soils of the tops of the hills, which were never submerged, are more suitable for tree growth than for agriculture.

"<u>Area Classification</u>

Aerial photography in the Assiniboine District is so far limited to a block extending from the eastern boundary of the Mountain district to Lake Manitoba, for which type-maps have been prepared, and small blocks in the vicinity of Winnipeg and Brandon which are not yet mapped. For the purpose of estimating

the value of the scattered and open forests, a special systematic reconnaissance was made of 7,826 square miles; an extensive general reconnaissance, with information found on existing maps, completed the information.

"The distribution of the classes of land tenure is to be found on page 105. The distribution in percentages is given below.

"The great preponderance of alienated lands is to be expected in an area where agriculture is so extensively developed as is the case in this district.

"CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES OF TENURE IN THE ASSINIBOINE DISTRICT

Tenure class -	Per cent of net land area
Timber licence	--
Pulpwood lease	--
Forest reserve	1.2
Vacant crown land	6.0
Alienated	92.8
	100.0

"<u>Estimate of Stand</u>

The total volume of wood now merchantable is 252,833,000 cubic feet of standing timber, the equivalent of 2,657,000 cords, of which 89.2 per cent is aspen, 10 per cent other hardwoods, and less than one per cent coniferous. The area occupied by young growth is 4,008 square miles, while there are 326 square miles of merchantable timber; the total forested area frr the district is thus 4,334 square miles (2,773,760 acres). The volume of material suitable for sawlogs is negligible.

"ASSINIBOINE DISTRICT: AREA CLASSIFICATION

All areas are in square miles

Description	Class of tenure: Timber licence	Pulpwood lease	Forest reserve	Vacant crown	Alienated	Total for District
Total area	--	--	333	2,668	24,404	27,405
Water	--	--	9	1,102	4	1,115
Net land	--	--	324	1,566	24,400	26,290
Non-Forested						
Cultivated	--	--	--	--	11,056	11,056
Grass	--	--	181	240	7,374	7,795
Muskeg	--	--	11	60	646	717
Rock	--	--	--	--	--	--
Brush	--	--	10	40	1,168	1,218
Towns and roads	--	--	--	951	118	1,069
Sub-Total	--	--	202	1,291	20,362	21,855
Non-Productive Forest						
Treed muskeg	--	--	16	3	--	19
Treed rock	--	--	--	--	--	--
Dry sites	--	--	2	10	70	82
Sub-Total	--	--	18	13	70	101
Productive Forest						
Softwoods -						
Merchantable	--	--	2	2	--	4
Young growth, 1 to 20 yrs		--	3	10	--	13
" " 21 to 40 "		--	5	-	--	5
" " 41 to 60 "		--	-	-	--	--
Mixedwoods -						
Merchantable	--	--	-	5	--	5
Young growth, 1 to 20 yrs.		--	1	5	--	6
" " 21 to 40 "		--	3	15	--	18
" " 41 to 60 "		--	-	-	--	--
Hardwoods -						
Merchantable	--	--	5	40	272	317
Young growth, 1 to 20 yrs.		--	21	90	1,507	1,618
" " 21 to 40 "		--	52	85	1,979	2,116
" " 41 to 60 "		--	12	10	210	232
Sub-total	--	--	104	262	3,968	4,334

"With the present unsatisfactory distribution of the young growth in age-classes, and under natural conditions of growth, the annual production of the forests as a whole is little more than enough to supply the yearly demand for fuel. The distribution of wood in the district is not uniform, and there are areas, particularly in the south and west, where the available supply of poplar fuel is not equal to the demand; in other localities, such as parts of the Pembina Hills, the production is larger than local users can absorb. At the same time, the accessibility of much of the wooded area is ideal, since most of it actually occurs on private lands, and it should, therefore, be possible to develop and apply simple cultural methods which would eventually increase the output several times over. The lack of an industrial market for the aspen at present, results in a lack of attention to the species, but if such a market can be developed the resulting benefit to the farmers in this district will be very great.

"The "other hardwoods" referred to in the estimates are principally bur oak, green and black ash, Manitoba maple, and white elm. The oak is frequently found on poor soils, where it occasionally excludes the aspen. The other species occur along the banks of streams, where they can obtain sufficient water for their needs. All of these species are so scattered in their occurrence that they are of purely local interest. Conifers in the district are almost negligible.

"ASSINIBOINE DISTRICT: TIMBER ESTIMATES

Class of Tenure	White Spruce Million ft. b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Other Conifers 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White Birch 1,000 cords	Other hardwoods 1,000 cords
Timber Licence	--	--	--	--	--	--	--	--	--	--	--
Pulpwood lease	--	--	--	--	--	--	--	--	--	--	--
Forest reserve	--	7	--	--	--	--	--	28	--	--	6
Vacant Crown	--	9	--	3	--	--	--	321	19	--	18
Alienated	--	--	--	--	--	--	---	2,025	90	--	131
Totals..	--	16	--	3	--	--	--	2,374	109	--	155
Equivalent in thousands of cubic feet standing timber	--	1,872	--	351	--	--	--	225,530	10,355	--	14,725

Total Volume of Mature Standing Timber Conifers, 2,223,000 cubic feet (19,000 cords); hardwoods, 250,610,000 cubic feet, (2,638,000 cords)"

"THE WHITEMOUTH DISTRICT

Area

The Whitemouth District has a total area of 5,841 square miles, of which 5,528 square miles is land and 313 square miles is water. It contains two forest reserves, the Sandilands and the Whiteshell.

"Description

It lies within the Manitoba Lowlands forest belt, except for the Whiteshell Forest Reserve which is part of the Northern Coniferous belt. There is a small area adjacent to the international boundary where white and red pine, which are characteristic of the forests of the Great Lakes, occur, but it is not considered to be of sufficient importance to require separate description.

"The population of the district is small in comparison with that of the Assiniboine District, and settlement is practically confined to the western half of the area. East of the Whitemouth river the country is practically uninhabited, except in the neighborhood of the railway lines. Grain-growing is strictly limited to the rather small areas of good clay soil, but there is a considerable amount of stock-raising and dairying.

"The climate is slightly more rigorous than that found to the west. The principal characteristic is the occurrence of many large swamps, particularly in the southeastern part of the area. These swamps or muskegs are frequently traversed by low ridges, often raised only a few feet above the surrounding terrain, which bear stands of jack pine and black spruce. In the swamps themselves drainage is poor and the formations of peat reach considerable thickness, while the tree growth is either so stunted as to give no hope of its becoming merchantable, or else is entirely absent. The soil underlying the muskegs varies from boulder clay to a fine sand, the latter type offering little promise of future usefulness for agricultural purposes even in places where it could be drained.

"<u>Area Classification</u>

"The estimates for this district are largely based on aerial photographic type-maps and on the results of two ground surveys, supplemented by reconnaissances.

"The tabulated figures respecting areas will be found in the table on page 109 The percentage distribution of classes of land tenure is as follows:

"CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES OF TENURE IN WHITEMOUTH DISTRICT

Tenure class -	Per cent of net land area
Timber licence	3.2
Pulpwood lease	--
Forest reserve	19.5
Vacant crown land	39.1
Alienated	38.2
Total:	100.0

"Estimate of Stand

The total volume of merchantable wood is estimated at 375,555,000 cubic feet of standing timber, or, 3,577,000 cords, of which 50.6 per cent is coniferous and 49.4 per cent hardwoods. The area occupied by young growth is 1,044 square miles, and there are 624 square miles of timber of merchantable size; the total area of productive forest is thus, 1,668 square miles (1,067,520 acres). The productive forest, therefore, occupied 2[illegible].6 per cent of the total area of the district."

"SUMMARY OF TIMBER ESTIMATES FOR WHITEMOUTH DISTRICT

Conifers

Species	Saw material, M ft.B.M.	Small material Cords	Total cubic volume M. Cu. ft.
White and Black Spruce	46,000	647,000	85,773
Balsam Fir	--	79,000	9,243
Jack Pine	20,000	706,000	86,931
Other Conifers	--	69,000	8,073
Total Conifers	66,000	1,501,000	190,020

Hardwoods

Species	Saw material, M ft.B.M.	Small material Cords	Total cubic volume M. Cu. ft.
Aspen and Balsam Poplar	85,000	1,726,000	182,590
Birch	--	24,000	2,280
Other Hardwoods	--	7,000	665
Total Hardwoods	85,000	1,757,000	185,535

"Jack pine is the dominant coniferous species; it is usually found in pure stands or in mixture with black spruce. Most of the white spruce is found in the neighborhood of the Winnipeg river.

"The only stands of white cedar of any importance to be found in the province occur in the swamps of this distrct, but even here the species generally occurs in scattered small groups. The only white pine in Manitoba is to be found between Whitemouth Lake and Buffalo Bay, and scattered red pine are to be found in the south of the district, but neither of these species occurs in commercial quantity. Considerable quantities of dry tamarack are still being cut from the swamps.

"WHITEMOUTH DISTRICT: AREA CLASSIFICATION

All areas are in square miles

Description	Timber Licence *	Pulp-wood lease	Forest reserve	Vacant crown	Aliena-ted	Total for District
	Class of tenure					
Total area	176	--	1,261	2,288	2,116	5,841
Water	1	--	185	126	1	313
Net land	175	--	1,076	2,162	2,115	5,528
Non-Forested						
Cultivated	--	--	--	--	320	320
Grass	--	--	13	6	354	373
Muskeg	44	--	118	959	688	1,809
Rock	1	--	15	--	--	16
Brush	7	--	11	64	41	123
Sub-total	52	--	157	1,029	1,403	2,641
Non-Productive Forest						
Treed muskeg	28	--	137	537	363	1,065
Treed rock	--	--	154	--	--	154
Dry sites	--	--	--	--	--	--
Sub-total	28	--	291	537	363	1,219

* Six square miles held under Timber Licence lie inside the boundaries of Forest Reserves."

"WHITEMOUTH DISTRICT: AREA CLASSIFICATION (cont'd)

All areas in square miles

Class of tenure

Productive Forest

Description	Timber license ✱	Pulp-wood lease	Forest Reserve	Vacant crown	Alienated	Total for District
Softwoods-						
Merchantable	30	--	87	117	74	308
Young growth, 1-20 yrs	5	--	90	28	6	129
" " 21-40 "	14	--	131	116	69	330
" " 41-60 "	5	--	47	40	22	114
Mixedwoods -						
Merchantable	12	--	28	69	43	152
Young growth, 1-20 yrs	5	--	31	8	3	47
" " 21-40 "	6	--	77	54	31	168
" " 41-60 "	5	--	17	14	10	46
Hardwoods -						
Merchantable	8	--	30	83	43	164
Young growth, 1-20 yrs	-	--	37	15	15	67
" " 21-40 "	5	--	38	47	30	120
" " 41-60 "	-	---	15	5	3	23
Sub-total	95	--	628	596	349	1,668

✱ Six square miles held under Timber Licence lie inside the boundaries of Forest Reserves."

"WHITEMOUTH DISTRICT: TIMBER ESTIMATES

Class of tenure	White Spruce Million ft.b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Other Conifers 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White Birch 1,000 cords	Other hardwoods 1.000 cords
Timber Licence	8	--	7	53	5	70	8	106	6	2	--
Pulpwood Lease	--	--	--	--	--	--	--	--	--	--	--
Forest Reserve	8	10	--	121	7	135	17	273	52	5	2
Vacant crown	8	--	8	278	42	332	27	927	38	11	5
Alienated	7	--	--	185	25	206	17	495	25	6	-
Totals	31	10	15	637	79	743	69	1,801	121	24	7
Equivalent in thousands of cubic feet standing timber	6,789	1,170	3,285	74,529	9,243	86,931	8,073	171,095	11,495	2,280	665

Total volume of Mature Standing timber: Conifers, 190,020,000 cubic feet (1,624,000 cords); hardwoods, 185,535,000 cubic feet (1,953,000 cords).

Note:- For estimates of total quantities of material suitable for sawlogs based on a minimum tree diameter of 10 inches in diameter at breast-height, see Table Z.

THE LAKE WINNIPEG EAST DISTRICT

"Area

The district contains 13,402 square miles of land and 917 square miles of water - a total of 14,319 square miles.

"Description

It is included in the Northern Coniferous forest belt, and is bounded on the west by Lake Winnipeg, on the south by the Winnipeg river, on the east by the boundary between Manitoba and Ontario, and on the north by the height of land which bounds the drainage into Lake Winnipeg.

"It lies at the western margin of the Canadian Shield, and its geological structure is pre-Cambrian, with the dominance of granites and gneisses characteristic of these formations. The topography of the eastern part is of a somewhat rolling nature, but local differences of elevation are seldom more than 100 feet. Hundreds of small lakes occur in the larger depressions between the rocky ridges, many of which are merely catchment basins without either inlets or outlets. Smaller depressions are occupied by muskegs in which sphagnum moss is dominant, with underlying layers of peat several feet in thickness. From east to west there is a gradual reduction of elevation from 1,050 feet above sea-level at the Ontario boundary to 715 feet at Lake Winnipeg. Extending inland from the lake to a distance of from ten to twenty miles is a swampy plain, occasionally broken by outcrops of rock.

"The district is traversed by eleven rivers and their tributaries, the direction of flow being west or northwest. The rivers are relatively small and contain numerous rapids and low falls; hence navigation is possible only by canoe. The river-banks are for the most part rocky and steep, and occasionally small river flats occur, where there are soils built up by deposits of silt. Rock ridges roughly parallel to the courses of the streams occur from one to three miles inland from both banks, and wide stretches of land in the interior are occupied by extensive swamps and muskegs.

"Climatic conditions are more severe than in the Assiniboine district, but are nevertheless quite favourable to tree

growth. Electric storms are of frequent occurrence in summer and in certain parts, particularly in the neighbourhood of the Berens River, such storms are often unaccompanied by rain Under such conditions lightning becomes a serious fire menace..

"Only a very small portion of the forest-bearing area has for its characteristic soil the deposits of silt in the river valleys. On the rocky ridges most of the forests grow in a thin soil of vegetable origin built up during long periods of time by a process which has been described on page 13. Peat soils are widely distributed in the muskegs, resting directly on the bedrock. In the northern extremity of the district there are some shallow deposits of clay.

"The dominant forest type is black spruce and jack pine, which occupies most of the ridges. Occasional stands of white and black spruce and aspen are found on the most favourable soils, but pure stands of poplar are somewhat scarce and seem to be always due to fires. Merchantable stands of pure black spruce are found in muskegs where there is sufficient drainage to allow of good growth. The moister sites are for the most part clothed with stunted black spruce and tamarack young growth. Practically all of the large tamarack are dead. Treed rock is common, on which the stands consist of jack pine, with occasional black spruce. This condition is always due to past fires which have destroyed most of the soil, leaving only small patches distributed in crevices and hollows of the rock. Each tree grows in its handful of soil, and the stands can never attain merchantable size because of the lack of nutrients and the limited room for root development.

"The primary value of the district lies in the production of forests. Soils adaptable to agriculture are of rare occurrence, and can never be expected to produce crops more than sufficient for local needs, except perhaps in the case of one small settlement along the Oiseau (or Bird) river to the east of Lac du Bonnet. Two producing gold mines have been established. A few commercial fishing stations are maintained on the shore of Lake Winnipeg. The fur trade is of some importance, and trapping is mainly carried on by Indians.

"The population is very small and scattered along the Winnipeg river and the lake. Aside from the mining properties and a few trading posts, the interior is uninhabited. It follows that the labour for woods work must be taken in from outside the district, and in the summer the lack of local population greatly increases the difficulties of fire suppression.

"There is one sawmill at the mouth of the Manigotagan river, but the wood in the pulpwood limits will go to the paper mill located on the south bank of the Winnipeg river. Transportation of logs must depend upon the waters of the numerous small rivers as far as the lake shore, and subsequently the wood must be brought to the south end of the lake in barges or rafts. The rivers themselves offer an abnormal number of obstacles to log driving in the form of rapids and lakes, and consequently requires expensive improvements. Lake Winnipeg is shallow and has short, choppy seas which may be found a great hinderance to rafting, while at the same time the shallow inshore waters make the loading of barges a difficult and hazardous operation. Altogether, the transportation operations for the wood in this distrct are full of difficulties which can be overcome only at considerable expense."

LAKE WINNIPEG EAST DISTRICT: AREA CLASSIFICATION

All areas are in square miles

Description	Class of tenure: Timber licence	Pulp-wood lease	Forest reserve	Vacant crown	Alien-ated	Total for district
Total area	180	2,452	--	11,608	79	14,319
Water	--	162	--	751	4	917
Net land	180	2,290	--	10,857	75	13,402
Non-Forested						
Cultivated	--	--	--	--	8	8
Grass	--	--	--	--	--	--
Muskeg	32	610	--	3,785	12	4,439
Rock	4	230	--	871	7	1,112
Brush	--	10	--	18	--	28
Sub-Total	36	850	--	4,674	27	5,587
Non-Productive Forest						
Treed muskeg	29	52	--	1,844	11	1,936
Treed rock	10	152	--	2,631	14	2,807
Dry sites	--	--	---	---	--	--
Sub-Total	39	204	--	4,475	25	4,743
Productive Forest						
Softwoods-						
Merchantable	21	464	--	9	3	497
Young growth, 1-20 yrs	21	89	--	187	1	298
" " 21-40 "	14	882	--	375	5	476
" " 41-60 "	10	54	--	255	-	319
Mixedwoods -						
Merchantable	23	171	--	2	2	198
Young growth, 1-20 yrs	---	80	--	200	1	281
" " 21-40 "	8	120	--	170	2	300
" " 41-60 "	-	74	--	134	-	208
Hardwoods-						
Merchantable	2	19	--	86	2	109
Young growth, 1-20 yrs	--	2	--	80	3	85
" " 21-40 "	6	73	--	183	4	266
" " 41-60 "	-	8	--	27	-	35
Sub-Total	105	1,236	--	1,708	23	3,072

"SUMMARY OF TIMBER ESTIMATE FOR LAKE WINNIPEG EAST DISTRICT

Conifers

Species	Saw Material M.Ft.B.M.	Small material Cords	Total cubic volume M. cu ft.
White and Black Spruce	89,000	1,829,000	233,509
Balsam Fir	4,000	140,000	17,316
Jack Pine	37,000	1,325,000	163,215
Other Conifers	---	---	---
Total Conifers	130,000	3,294,000	414,040

Hardwoods

Species	Saw Material M.Ft.B.M.	Small material Cords	Total cubic volume M. cu ft.
Aspen and Balsam Poplar	89,000	1,858,000	196,080
Birch	--	47,000	4,465
Other Hardwoods	--	--	--
Total Hardwoods	89,000	1,905,000	200,545

LAKE WINNIPEG EAST DISTRICT: TIMBER ESTIMATES

Class of Tenure	White Spruce Million ft.b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Other Conifers 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White Birch 1,000 cords	Other Hardwoods 1,000 cords
Timber Licence	28.5	--	12	92	19	56	--	107	11	3	--
Pulpwood Lease	--	77	--	1,710	121	1,315	--	850	85	21	--
Forest reserve	--	--	--	--	--	--	--	--	--	--	--
Vacant Crown	--	2	--	28	8	18	--	896	85	22	--
Alienated	--	--	--	11	--	6	--	27	3	1	--
Total	28.5	79	12	1,841	148	1,395	--	1,880	184	47	--
Equivalent in thousands of cubic feet standing timber	6,241.5	9,243	2,628	215,397	17,316	163,215	--	178,600	17,480	4,465	--

Total Volume of Mature Standing Timber: Conifers 414,040,500 cubic feet (3,539,000 cords): Hardwoods, 200,545,000 cubic feet (2,111,000 cords)."

THE LAKE WINNIPEG DISTRICT

Area

The district includes Lake Winnipeg with its islands, and the lands lying immediately to the west. Its total area is 17,620 square miles, made up of 9,540 square miles of water and 8,080 of land.

"Description

The Lake Winnipeg district occupies the lowest levels in the Manitoba Lowlands forest belt. At the narrowest part of the lake there is a notable contrast between the granitic rocks on the east shore and the limestone on the west, which is explained by the fact that the line of contact between the formations of the Canadian Shield and the later sedimentary rocks lies in the lake bed, appearing only at the surface where it crosses Black Island. The land surface is practically level, although the low shore line is broken by occasional headlands with limestone cliffs. A few low ridges run in a north and south direction, but otherwise the land is so little elevated above the lake that drainage is very poor. This is particularly true in the northern half of the district, where a large portion of the area is occupied by wet swamps and lakes. Towards the south, conditions are somewhat better, but here, too, there is a large area of poorly drained land.

"Climatic conditions are similar to those in the district to the east, except that dry lightning storms do not cause the same fire risk.

"The soils all originated from glacial drift, but at the surface the material has been reassorted and otherwise modified by the wave action to which it was subjected as Lake Agassiz subsided towards the level of the residual lakes. In the best localities there are clay loams of good depth, but elsewhere the soil covering the underlying limestones is very shallow. In the areas of poor drainage there are extensive tracts of muck and peat.

"Since the forest belt in which this district lies is of the nature of a transition belt, it is difficult to designate any one forest type as typical of the whole. On the best sites, such as the low dykes occurring on lake shores and in other places where both soil and drainage are good, there are stands of the spruce-poplar subtype which are similar in many respects to the typical stands of the Mixedwood belt. Black spruce and young tamarack occupy swamps which are not so wet as to exclude tree growth, while jack pine, sometimes with an admixture of spruce, dominates the gravel and sand ridges and other areas where drainage is good but soil is thin. The poplar type in the northern part is due almost exclusively to fire, but in the southern half of the district is of more importance and greater stability.

"The southern end of the district is fairly well populated and there is a considerable amount of farming. On the lake shore are a number of settlements where the main activity is commercial fishing. In the northern parts there is no agricultural development, and settlement is confined to one or two points on the lake front. Whether it will eventually be possible to drain some of the swamp

lands for farming purposes is unknown, but it is probable that a considerable portion of these areas cannot be drained while Lake Winnipeg retains its present level.

"There are several sawmills of small size, and some areas of timber are leased for pulpwood. Transportation in the southern part depends on railways and roads, but in the north all wood cut must be hauled to Lake Winnipeg and then barged or rafted to its destination. The difficulties of the latter means of transport are the same as in the case of the district to the east, but, on the other hand, wood does not have to be driven down streams and the construction of log roads is easy on account of the flat topography. Mose of the merchantable wood occurs very close to the lake."

"CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES OF TENURE IN LAKE WINNIPEG DISTRICT

Tenure class -	Per cent of net land area
Timber licence	3.6
Pulpwood lease	3.5
Forest reserve	--
Vacant crown land	71.9
Alienated	21.0
Total	100.0

LAKE WINNIPEG DISTRICT: AREA CLASSIFICATION

All areas are in square miles

Description	Timber licence	Pulpwood lease	Forest reserve	Vacant crown	Alienated	Total for District
	Class of tenure					
Total area	302	296	--	15,326	1,696	17,620
Water	7	16	--	9,516	1	9,540
Net Land	295	280	--	5,810	1,695	8,080
Non-Forested						
Cultivated	--	--	--	--	467	467
Grass	8	2	--	15	414	439
Muskeg	113	128	--	3,056	123	3,420
Rock	--	--	--	1	--	1
Brush	2	3	--	66	20	91
Sub-Total	123	133	--	3,138	1,024	4,418
Non-Productive Forest						
Treed muskeg	9	--	--	1,528	50	1,587
Treed rock	--	--	--	2	--	2
Dry sites	--	--	--	--	--	--
Sub-Total	9	--	--	1,530	50	1,589
Productive Forest						
Softwoods-						
Merchantable	32	33	--	38	13	116
Young growth, 1-20yr	18	17	--	220	25	280
" " 21-40 yr.	12	6	--	160	38	216
" " 41-60 "	9	11	--	103	9	132
Mixedwoods -						
Merchantable	58	60	--	48	22	188
Young growth 1-20yr.	1	--	--	96	30	127
" " 21-40 "	14	9	--	118	49	190
" " 41-60 "	-	-	--	25	12	37
Hardwoods -						
Merchantable	3	2	--	65	76	146
Young growth 1-20yr	8	3	--	118	140	269
" " 21-40 "	8	6	--	136	182	332
" " 41-60 "	-	--	--	15	25	40
Sub-Total	163	147	--	1,142	621	2,073

"ESTIMATE OF STAND

The estimated total volume of standing timber of merchantable size is 316,488,500 cubic feet (3,145,000 cords), of which 29.6 per cent is coniferous and 7.4 per cent is hardwood. Merchantable timber occupies 450 square miles, and there are 1,623 square miles of young growth; so the total area of productive forest is 2,073 square miles (1,326,720 acres). Productive forests, therefore, occupy 11.8 per cent of the whole district."

"SUMMARY OF TIMBER ESTIMATE FOR LAKE WINNIPEG DISTRICT

Species	Saw material M.Ft.B.M.	Small material Cords	Total cubic volume M. cu. ft.
Conifers			
White and Black Spruce	71,000	470,000	70,525
Balsam fir	1,000	47,000	5,733
Jack Pine	8,000	135,000	17,550
Other Conifers	--	--	--
Total Conifers	80,000	652,000	93,808
Hardwoods			
Aspen and Balsam Poplar	100,000	2,069,000	218,405
Birch	--	45,000	4,275
Other Hardwoods	--	--	--
TotalHardwoods	100,000	2,114,000	222,680

LAKE WINNIPEG DISTRICT : TIMBER ESTIMATES

Class of tenure	White Spruce Million Ft.b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Other Conifers 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White Birch 1,000 cords	Other Hardwoods 1,000 cords
Timber Licence	25.5	1	13	98	13	35	--	247	56	6	--
Pulpwood Lease	--	41	--	239	27	4	--	246	62	6	--
Forest reserve	--	--	--	--	--	--	--	--	--	--	--
Vacant Crown	7.0	13	--	91	7	101	--	687	166	17	--
Alienated	3.0	5	--	24	2	10	--	670	165	16	--
Totals	35.5	60	13	452	49	150	--	1,850	449	45	--
Equivalent in thousands of cubic feet standing timber	7,774.5	7,020	2,847	52,884	5,733	17,550	--	175,750	42,655	4,275	--

Total Volume of Mature Standing Timber: Conifers, 93,805,500 cubic feet (801,000 cords); Hardwoods, 222,680,000 cubic feet (2,344,000 cords)

"THE WINNIPEGOSIS DISTRICT

Area

"The district embraces Lake Winnipegosis and the northern half of Lake Manitoba, as well as several smaller lakes. The area of water is 3,765 square miles, and of land 8,750 square miles - a total of 12,515 square miles.

"Description

The Winnipegosis area is part of the Manitoba Lowlands forest belt and, therefore, has many points of similarity to the Lake Winnipeg district. The underlying rock formations are principally limestones, with limited occurrences of sandstones and shales. The topography is flat with local differences of elevation seldom exceeding 20 feet. The Kettle Hills, on the western side of the district, reach a height of 1,100 feet above sea-level. The level of the principal lake is 831 feet. In their retreat towards the north-east, the glaciers deposited numerous low gravel or sand ridges at right angles to the general slope of the land and these interfere with such drainage as would ordinarily have occurred in the low-lying swamp lands. Terminal moraines mark the northern end of Lake Winnipegosis and modify the course of drainage at the south.

"Soils of the northern or forested part of the district are composed of low moraines or old beaches of boulder clay, gravel, or sand; and clays which are for the most part overlain by peat formed by the sphagnum moss of the bogs. Towards the south the soil consists of glacial till modified by wave action and in places fairly stony, with limited occurrences of peat.

"Spruce-poplar forests are found on the moraines and old beaches near the lakes, and there is one such stand on the Overflowing river surrounded by a vast open swamp. Black spruce is common in the swamps, but jack pine is of very limited occurrence except on the higher lands near the western boundary of the area. Poplar forests are common in the southern part and also near the shores of the northern lakes.

"The population of the district is mainly confined to the southern end, where there is considerable agricultural development. Settlement north of the south end of Lake Winnipegosis is scanty, and the area of farms is negligible. The principal industry is fishing.

"One or two sawmills and a plant for cutting pulpwood logs into shorter lengths represent the only local forest industries. Logs must be transported on Lake Winnipegosis after being hauled to its shores, and the difficulties of towing are much the same as in the case of Lake Winnipeg. The extreme shallowness of the lake makes it so rough in a wind that logs must be made into rafts rather than floated in booms, and in many places it is impossible for a tug boat to approach within two miles of the shore.
"

CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES
OF LAND TENURE IN WINNIPEGOSIS DISTRICT

Tenure Class	Per Cent of net land area
Timber licence	1.6
Pulpwood lease	0.6
Forest reserve	--
Vacant crown	70.2
Alienated	27.6
Total..	100.0

"Practically all of the alienated lands are confined to the southern or agricultural part of the district.

"Estimate of Stand

The volume of merchantable timber is 542,657,500 cubic feet, (5,438,000 cords), of which 25.5 per cent is coniferous and 74.5 per cent hardwood. Merchantable wood occupies 525 square miles and there are 2,462 square miles of young growth, the total area of productive forest being 2,987 square miles, or 1,911,680 acres. Productive forests comprise 23.9 per cent of the total area of the district.

"WINNIPEGOSIS DISTRICT: AREA CLASSIFICATION
All areas in square miles

Description	Timber licence	Pulp-wood lease	Forest reserve	Vacant crown	Alienated	Total for district
	Class of tenure					
Total area	144	51	--	9,898	2,422	12,515
Water	4	1	--	3,758	2	3,765
Net land	140	50	--	6,140	2,420	8,750
			Non-Forested			
Cultivated	--	--	--	--	395	395
Grass	4	--	--	291	792	1,087
Muskeg	37	15	--	2,835	139	3,026
Rock	--	--	--	--	--	--
Brush	12	--	--	122	67	201
Sub-total	53	15	--	3,248	1,393	4,709
			Non-Productive Forest			
Treed muskeg	--	--	--	1,018	36	1,054
Treed rock	--	--	--	--	--	--
Dry sites	--	--	--	--	--	--
Sub-total	--	--	--	1,018	36	1,054

" WINNIPEGOSIS DISTRICT: AREA CLASSIFICATION (cont'd)
All areas are in square miles

Productive Forest

Description	Class of tenure					Total for District
	Timber Licence	Pulp wood lease	Forest Reserve	Vacant Crown	Alienated	
Softwoods -						
Merchantable	24	22	--	76	17	139
Young growth 1 to 20 yrs.	9	--	--	95	49	153
Younggrowth 21 to 40 yrs.	4	1	--	228	66	299
Young growth 41-60 yrs.	-	-	--	56	14	70
Mixedwoods						
Merchantable	20	7	--	29	21	77
Young growth 1 - 20 years	7	2	--	322	91	422
Young growth 21-40 years	8	1	--	120	86	215
Young growth 41-60 years	-	-	--	29	20	49
Hardwoods						
Merchantable	7	2	--	204	96	309
Young growth 1 - 20 years	6	-	--	360	230	596
Young growth 21-40 years	2	-	--	320	270	592
Young growth 41-60 years	-	-	--	35	31	66
Sub-total	87	35	--	1,874	991	2,987

"Detailed estimates of merchantable timber, divided under different classes of land tenure are found on page 127 . In that table volumes are given in cords, with the exception of that quantity of spruce which, owing to the class of land tenure or other conditions, is considered to be available for the production of lumber. Considering all trees of 10 inches in diameter at breast-height and over as suitable for saw material, regardless of their ultimate probable use, the stand in this district may be estimated as follows:-

"SUMMARY OF TIMBER ESTIMATE FOR WINNIPEGOSIS DISTRICT

Conifers

Species	Saw material M Ft.B.M.	Small material Cords	Total cubic volume M cu. ft.
White and Black Spruce	95,000	849,000	120,202
Balsam Fir	--	41,000	4,797
Jack Pine	3,000	108,000	13,338
Other Conifers	--	--	--
Total Conifers	98,000	998,000	138,337
	Hardwoods		
Aspen and Balsam Poplar	270,000	3,529,000	394,440
Birch	4,000	94,000	9,880
Other Hardwoods	--	--	--
Total Hardwoods	274,000	3,623,000	404,320

TIMBER ESTIMATES: WINNIPEGOSIS DISTRICT

Class of Tenure	White Spruce Million ft.b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White Birch 1,000 cords
Timber Licence	--	151	--	68	16	5	153	51	5
Pulpwood Lease	--	84	--	33	2	4	49	16	2
Forest Reserve	--	--	--	--	--	--	--	--	--
Vacant Crown	40.5	222	5.5	236	17	69	1,958	653	65
Alienated	12.0	49	1.5	73	6	36	954	318	32
Totals	52.5	506	7.0	410	41	114	3,114	1,038	104
Equivalent in thousands of cu.ft. of standing timber -	1,497.5	59,202	1,533	47,970	4,797	13,338	295,830	98,610	9,880

Total Volume of Mature Standing Timber: Conifers, 138,337,500 cubic feet (1,182,000 cords): Hardwoods, 404,320,000 cubic feet (4,256,000 cords)

"THE MOUNTAIN DISTRICT

Area

The Mountain district contains 6,495 square miles, of which 185 are occupied by water. Of the net land area of 6,310 square miles, nearly one-half is included in two forest reserves and a national partk, namely, the Duck Mountain and Porcupine Forest Reserve and the Riding Mountain National Park.

Description

The district coincides with the Mixedwood forest belt. The forest reserves and the park include three sections of the Manitoba escarpment, with maximum elevations above sea-level exceeding 2,700 feet. Towards the east and northeast they are characterized by steep slopes, frequently furrowed and gullied by the course of small streams; to the west they graudally slope away to the general level of the second prairie steppe. The soil owes its origin to terminal moraines of glaciers, and reaches thicknesses up to 100 feet or more. The higher levels were not submerged by Lake Agassiz and their surface deposits have been but little modified by the action of water. Much of the soil is unfit for agriculture, but practically all of it is splendidly adapted to the production of tree crops.

"At the bases of the hills and in the valleys between them, there are fertile tracts well suited to farming, particularly in the valley of the Swan River, where rich deposits of silt overlie the boulder clay.

"The Swan is the most important river, but the district is well watered by numerous small streams which take their rise in the hills and flow in an easterly direction into Lakes Winnipegosis, Dauphin and Manitoba. An important feature of the area is the series of low sand and gravel ridges which represent old beaches of Lake Agassiz.

"The climate is similar to that of the Assiniboine district except that at the higher elevations the length of the growing season is reduced by late spring and early autumn frosts, while the average amount of precipitation is slightly higher.

"The characteristic forest sub-type is a mixture of white spruce and poplar. Stands of this kind produce excellent spruce sawlogs of large size; and it is worthy of note that the spruce seems to grow better when mixed with poplar than it does in pure stands. Muskegs are occupied by black spruce and young tamarack, which may or may not be valuable according to the degrees of moisture. Jack pine is prevalent as a fire type, but there are relatively few sites on which this species can be considered as a climax forest. Pure stands of aspen and balsam poplar occupy a large proportion of the forested area, and the trees of these species attain their largest sizes in this district. The prevalence of this type is believed to be due to forest fires, since burned areas of rich soil are easily seeded in by these species, and, once the hardwoods are established, there may be a long delay before the more valuable conifers can regain a footing.

"The main activity of the district is farming, which occupies the greater part of the population. There are a number of small sawmills, mostly of the portable type, which draw their timber mainly from the forest reserves and park. Logs are usually hauled

from the forest reserves by team and manufactured locally. There are still a few streams which can be driven, including the Valley, Woody and Shell rivers."

"CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES OF LAND TENURE IN THE MOUNTAIN DISTRICT.

Tenure Class		Per Cent of net land area
Timber licence		3.4
Pulpwood lease		--
Forest reserves		48.3
Vacant Crown Lands		8.1
Alienated		40.2
	Total.	100.0

"Nearly one-half of the district is reserved as forest or park. It is to be noted that the majority of the timber licences cover lands lying within the boundaries of the forest reserves. These privileges were granted before the reserves were established as such, and when they expire further berths within the reserves will not be granted; but in the meantime it is necessary to include the lands in question under "timber licence" rather than under "forest reserve". This explains an apparent discrepancy which will be found if the area tabulated above under forest reserves is compared with the total of the areas as given in the individual descriptions of the reserves and the park.

"Estimate of Stand

The total volume of merchantable wood is estimated to be 1,020,284,500 cubic feet of standing timber (10,302,000 cords), of which 21.7 per cent is coniferous, and 78.3 per cent is hardwood. The area occupied by merchantable timber is 819 square miles, and there are 3,128 square miles of young growth; the total productive forest area is thus 3,947 square miles (2,526,080 acres), which represent 60.8 per cent of the total area of the district."

SUMMARY OF TIMBER ESTIMATE FOR MOUNTAIN DISTRICT

Conifers

Species	Saw Material M Ft.B.M.	Small Material Cords	Total cubic volume M. cu.ft
White and Black Spruce	507,000	634,000	185,320
Balsam Fir	--	48,000	5,616
Jack Pine	14,000	233,000	30,303
Other Conifers	--	--	--
Total Conifers	521,000	915,000	221,239

Hardwoods

Species	Saw Material M Ft.B.M.	Small Material Cords	Total cubic volume M. cu.ft
Aspen and Balsam Poplar	1,040,000	5,595,000	759,335
Birch	18,000	369,000	33,950
Other Hardwoods		8,000	760
Total Hardwoods	1,058,000	5,972,000	799,045

"In reading the foregoing figures, it must be remembered that the division between saw material and cordage is based on size only. Most of the poplar classed as of saw material size, cannot actually be used for that urpose on account of damage by fungi, although the same trees may be quite suitable for fuel."

" MOUNTAIN DISTRICT: AREA CLASSIFICATION
All areas are in square miles

Description	Class of tenure: Timber licence*	Pulpwood lease	Forest reserve	Vacant crown	Alienated	Total for District
Total Area	223	--	3,180	557	2,535	6,495
Water	8	--	130	47	--	185
Net land	215	--	3,050	510	2,535	6,310
Non-Forested						
Cultivated	--	--	--	--	810	810
Grass	1	--	87	50	755	893
Muskeg	8	--	75	50	85	218
Rock	--	--	--	--	--	--
Brush	2	--	44	20	115	181
Sub -Total	11	--	206	120	1,765	2,102

*169 square miles, held under Timber Licence, lie within the boundaries of Forest Reserves.

"MOUNTAIN DISTRICT: AREA CLASSIFICATION (cont'd)

All areas in square miles

Non-Productive Forest

Description	Timber licence*	Pulp-wood lease	Forest Reserve	Vacant crown	Alien-ated	Total for District
	Class of tenure					
Treed muskeg	8	--	238	--	15	261
Treed rock	--	--	--	--	--	--
Dry sites	--	--	--	--	--	--
Sub-Total	8	--	238	--	15	261

Productive Forest

Description	Timber licence*	Pulp-wood lease	Forest Reserve	Vacant crown	Alien-ated	Total for District
Softwoods -						
Merchantable	28	--	58	5	7	98
Young growth, 1-20 yrs.	2	--	67	20	3	92
" " 21-40 "	10	--	248	30	8	296
" " 41-60 "	4	--	37	10	2	53
Mixedwoods-						
Merchantable	62	--	183	10	15	270
Young growth, 1-20 yrs.	13	--	123	8	10	154
" " 21-40 "	32	--	330	15	50	427
" " 41-60 "	5	--	176	7	5	193
Hardwoods-						
Merchantable	20	--	302	40	89	451
Young growth, 1-20 yrs.	10	--	359	100	220	689
" " 21-40 "	10	--	471	110	310	901
" " 41-60 "	-	--	252	35	36	323
Sub-total	196	--	2,606	390	755	3,947

* 169 square miles, held under Timber Licence, lie within the boundaries of Forest Reserves.

MOUNTAIN DISTRICT : TIMBER ESTIMATES

Class of tenure	White Spruce Million ft.b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White Birch 1,000 cords	Other Hardwoods. 1,000 cords
Timber licence	195.0	60	36	59	6	33	535	160	40	--
Pulpwood Lease	--	--	--	--	--	--	--	--	--	--
Forest Reserve	250.5	277	18	192	37	213	4,195	1,113	256	5
Vacant Crown	3.0	12	--	6	2	6	486	145	36	3
Alienated	5.0	19.	--	9	3	7	1,045	314	78	--
Totals	453.5	368	54	266	48	259	6,261	1,732	410	8
Equivalent in thousands of cubic feet standing timber	99,316.5	43,056	11,826	31,122	5,616	30,303	594,795	164,540	38,950	760

Total Volume of Mature Standing Timber : Conifers, 221,239,500 cubic feet (1,891,000 cords); Hardwoods, 799,045,000 cubic feet, (8,411,000 cords) "

"THE SASKATCHEWAN RIVER DISTRICT

AREA

The district contains an area of 8,535 square miles, of which 6,250 square miles is land and 2,285 square miles is water.

Description

The district lies in the northern extension of the Manitoba lowlands forest belt and comprises those areas which drain into the river from which it takes its name. The underlying rocks are mainly limestones. The land surface is level and low-lying, with a large extent of poorly drained area as a natural consequence of the small differences in elevation. Three large bodies of water, known as Cedar, Moose, and Cormorant lakes, together with the main river, make up most of the large water area. The Saskatchewan river frequently floods large tracts of the land west of the larger lakes and has formed a maze of channels, many of them now abandoned. Thick deposits of glacial clay cover the bed rock, and these in turn are overlain by a heavy burden of alluvial silt. East of Cedar and Moose lakes the soil is thin and in many places is of vegetable origin, appearing either as peat in the muskegs, or on the higher land as a rock-covering formed in the manner described in the case of the granite ridges east of Lake Winnipeg. Near the river, and sometimes crossing the larger swamps, are low ridges of gravel, sand, and boulder clay. There is a somewhat larger proportion of grassy swamps in this district than in other parts of the province.

"Black spruce is the most import nt tree of the district, growing either in pure stands or in mixture with poplar. White spruce of sizes suitable for saw-timber is in general restricted to the sites where soil and drainage are better than the average. Jack pine is widely distributed, and the prevalence of fires has encouraged the propagation of this species to so great an extent that it now dominates the young growth throughout the area.

"The Pas is the only town in the district, but there are two mining developments of importance, the Flin Flon, lying partly in Manitoba and partly in Saskatchewan, and Sherridon, the site of the Sherritt-Gordon mine. Aside from these places, the population is small, and is distributed along the Hudson Bay Railway and in a few trading posts along the river. Agriculture is practically limited to gardens for the production of vegetables for local use. At The Pas is the largest sawmill establishment in the province, but this mill obtains all of its wood supplies from Saskatchewan. Transportation of logs from the Saskatchewan river drainage would be difficult unless there were a mill established at the river mouth. Even then the floatation of wood would be fairly expensive, owing to the number of old river channels, and the large lakes where towing would be required. This, no doubt, explains the fact that very little exploitation of the forests has been carried on."

"CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES OF TENURE IN THE SASKATCHEWAN RIVER DISTRICT

Tenure class -	Per cent of net land area
Timber licence	3.0
Pulpwood lease	--
Forest reserve	--
Vacant crown land	95.0
Alienated	2.0
Total	100.0

SASKATCHEWAN RIVER DISTRICT: AREA CLASSIFICATION
All areas are in square miles

Description	Class of tenure: Timber Licence	Vacant Crown	Alienated	Total for District
Total area	191	8,219	125	8,535
Water	6	2,279	--	2,285
Net land	185	5,940	125	6,250
Non-Forested				
Cultivated	--	--	7	7
Grass	--	67	24	91
Muskeg	24	1,858	18	1,900
Rock	--	100	2	102
Brush	2	47	10	59
Sub-Total	26	2,072	61	2,159
Non-Productive Forest				
Treed muskeg	14	1,332	12	1,358
Treed rock	5	288	--	293
Dry sites	--	--	--	--
Sub-total	19	1,620	12	1,651
Productive Forest				
Softwoods-				
Merchantable	50	98	1	149
Young growth, 1-20 yrs.	23	446	-	469
" " 21-40 "	24	510	14	548
" " 41-60 "	--	208	-	208
Mixedwoods -				
Merchantable	9	42	4	55
Young growth, 1-20 yrs.	12	239	-	251
" " 21-40 "	13	153	10	176
" " 41-60 "	--	87	--	87
Hardwoods-				
Merchantable	--	28	5	33
Young growth, 1-20 yrs.	4	298	5	307
" " 21-40 "	5	124	13	142
" " 41-60 "	--	15	--	15
Sub-total	140	2,248	52	2,440

"The predominance of vacant Crown lands accurately reflects the lack of development of the district. What future uses may be found for this area cannot be predicted, but it is fairly certain that there are extensive tracts where the soil conditions will not permit of farming. At the same time the area is not well suited to an intensive scheme of forest management, so that whatever value it has must continue to depend mainly on naturally grown forests.

"Estimate of Stand

The volume of merchantable standing timber is estimated at 137,875,000 cubic feet (1,292,000 cords), of which 58.5 per cent is coniferous and 41.5 per cent hardwoods. Merchantable timber occupies 237 square miles and there are 2,203 square miles of young growth, the total area of productive forest being 2,440 square miles (1,561,600 acres). The useful forests, therefore, comprise 28.6 per cent of the total area of the district."

"SUMMARY OF TIMBER ESTIMATE FOR SASKATCHEWAN RIVER DISTRICT

Conifers

Species	Saw material M.ft.b.m.	Small material cords	Total cubic volume M. cu. ft.
White and Black Spruce	81,000	394,000	63,837
Balsam Fir	----	9,000	1,053
Jack Pine	4,000	128,000	15,795
Total Conifers	85,000	531,000	80,685

Hardwoods

Species	Saw material M.ft.b.m.	Small material cords	Total cubic volume M. cu. ft.
Aspen and Balsam Poplar	13,000	550,000	55,005
Birch	---	23,000	2,185
Total Hardwoods	13,000	573,000	57,190

"SASKATCHEWAN RIVER DISTRICT: TIMBER ESTIMATES

	White Spruce		Black Spruce		Balsam Fir	Jack Pine	Aspen	Balsam Poplar	White Birch
Class of Tenure	Million ft.b.m.	1,000 cords	Million ft.b.m.	1,000 cords	1,000 cords	1,000 cords	1,000 cords	1,000 cords	1,000 cords
Timber Licence	38	67	25	65	5	45	35	8	1
Pulpwood Lease	--	--	--	--	--	--	--	--	--
Forest Reserve	--	--	--	--	--	--	--	--	--
Vacant Crown	17	78	--	178	4	87	376	93	19
Alienated	1	1	--	5	-	3	54	13	3
Totals	56	146	25	248	9	135	465	114	23
Equivalent in thousands of cubic feet-standing timber	12,264	17,082	5,475	29,016	1,053	15,795	44,175	10,830	2,185

Total Volume of Mature Standing Timber: Conifers, 80,685,000 cubic feet (690,000 cords;) Hardwoods, 57,190,000 cubic feet (602,000 cords)

"THE UPPER NELSON DISTRICT

Area

The Upper Nelson District contains 10,760 square miles of land and 1,640 square miles of water, a total area of 12,400 square miles.

"Description

The district lies in the Northern Coniferous forest belt with the exception of a small tract in the southwest corner which falls within the Manitoba Lowlands. The predominant rock formations are granites and gneisses as is the case in the Lake Winnipeg East district, but the topography is more level and monotonous. There are practically no hills worthy of the name, and the larger part of the district is occupied by poorly drained muskegs. The Nelson river as it passes through this district has low banks and there are numerous and extensive lake-like expansions along its course; of these the two most important are Cross and Sipiwesk lakes. In spite of its gradual fall in elevation, the Nelson offers great possibilities for the development of hydro-electric power on account of the volume and velocity of its flow.

"It has been estimated that nearly two-thirds of the soils of the district are comprised of muck or peat, while less than one-fifth of the land consists of clay soil. Climatic conditions are decidedly more rigorous than in the southern parts of the province, and the length of the growing season is reduced to less than one hundred days.

"Black Spruce is the most important tree, and is found in sizes suitable for pulpwood on the better sites, and in a stunted condition in the extensive muskegs. White spruce, generally mixed with poplar, occupies some of the best sites, and jack pine occurs on all of the sandy areas and in some cases on the clay soil as well. On the latter sites it is probably a fire type, and therefore temporary. Poplar grows in mixture with the spruces; its occurrence in pure stands is limited to old burns.

"With the exception of Indian Reserves, missions, and a few trading posts, the district is uninhabited. A small fur trade is carried on with the local Indians and a few white trappers, but otherwise there are practically no activities of importance. Possibilities of agricultural development in the future are limited by thelack of good soils and the severity of the climate, and it is hardly to be expectdd that this district can ever produce crops more than sufficient to supply local requirements. Transportation of wood under present conditions would have to be done by floating it down the Nelson river. The rapid current and the large lakes, together with multiplicity of channels, would make this process expensive, and only to be undertaken by a concern operating on a large scale. A pulp mill located near the railway bridge over the river would seem to be the answer to the problem of utilizing the wood in the district."

"CLASSIFICATION OF LANDS HELD UNDER THE VARIOUS CLASSES OF TENURE IN THE UPPER NELSON DISTRICT

Tenure class -	Per cent of net land area
Timber licence	--
Pulpwood lease	--
Forest reserve	.
Vacant crown land	99.5
Alienated	0.5
Total	100.0

"UPPER NELSON DISTRICT: AREA CLASSIFICATION

All areas in square miles

Description	Timber Licence	Pulpwood lease	Forest reserve	Vacant crown	Alienated	Total for District
	Class of Tenure					
Total area	--	--	--	12,344	56	12,400
Water	--	--	--	1,639	1	1,640
Net land	--	--	--	10,705	55	10,760
Non-Forested						
Cultivated	--	--	--	--	--	--
Grass	--	--	--	84	--	84
Muskeg	--	--	--	3,330	15	3,345
Rock	--	--	--	83	--	83
Brush	--	--	--	115	5	120
Sub-total	--	--	--	3,612	20	3,632
Non-Productive Forest						
Treed muskeg	--	--	--	2,875	10	2,885
Treed rock	--	--	--	1,283	5	1,288
Dry sites	--	--	--	--	--	--
Sub-total	--	--	--	4,158	15	4,173
Productive Forest						
Softwoods -						
Merchantable	--	--	--	244	--	244
Young growth 1-20 yrs -	--	--	--	400	--	400
" " 21-40 "	--	--	--	291	10	301
" " 41-60 "	--	--	--	125	--	125
Mixedwoods -						
Merchantable	--	--	--	86	--	86
Young growth 1-20 yrs -	--	--	--	540	--	540
" " 21-40 "	--	--	--	176	--	176
" " 41-60 "	--	--	--	85	--	85
Hardwoods -						
Merchantable	--	--	--	13	--	13
Young growth 1-20 yrs -	--	--	--	694	--	694
" " 21-40 "	--	--	--	253	10	263
" " 41-60 "	--	--	--	28	--	28
Sub-Total	--	--	--	2,935	20	2,955

"Estimate of Stand

The estimated volume of merchantable wood is 267,967,000 cubic feet of standing timber (2,391,000 cords), of which 81.1 per cent is coniferous, while 18.9 per cent is hardwood. The merchantable timber occupies an area of 343 square miles, and there are 2,612 square miles of young growth - a total area of productive forest of 2,955 square miles (1,891,200 acres). The productive forest represents 23.8 per cent of the total area of the district.

"SUMMARY OF TIMBER ESTIMATE FOR UPPER NELSON DISTRICT

Conifers

Species	Saw material M.ft.b.m.	Small material cords	Total cubic volume M. cu. ft.
White and Black Spruce	59,000	1,290,000	163,863
Balsam Fir	--	13,000	2,106
Jack Pine	5,000	430,000	51,36[illegible]
Other Conifers	--	--	--
Total Conifers	64,000	1,7[illegible],000	217,332
Hardwoods			
Aspen and Balsam Poplar	11,000	490,000	49,020
Birch	--	17,000	1,615
Other Hardwoods	--	--	--
Total Hardwoods	11,000	50[illegible],000	50,6[illegible]5

UPPER NELSON DISTRICT: TIMBER ESTIMATES

Class of Tenure	White Spruce Million ft.b.m.	White Spruce 1,000 cords	Black Spruce Million ft.b.m.	Black Spruce 1,000 cords	Balsam Fir 1,000 cords	Jack Pine 1,000 cords	Aspen 1,000 cords	Balsam Poplar 1,000 cords	White birch 1,000 cords
Timber Licence	--	--	--	--	--	--	--	--	--
Pulpwood Lease	--	--	--	--	--	--	--	--	--
Forest Reserve	--	--	--	--	--	--	--	--	--
Vacant Crown	27	149	--	1,201	18	439	430	86	17
Alienated	--	--	--	--	--	--	--	--	--
Totals	27	149	--	1,201	18	439	430	86	17
Equivalent in thousands of cubic feet of standing timber	5,913	17,433	--	140,517	2,106	51,363	40,850	8,170	1,615

Total Volume of Mature Standing Timber: Conifers, 217,332,000 cubic feet (1,858,000 cords): Hardwoods, 50,635,000 cubic feet (533,000 cords)."

"THE INACCESSIBLE AREAS

While the preparation of detailed estimates has been undertaken for only those parts of Manitoba which have been classed as accessible, it is desirable to set down such general information as is available regarding the inaccessible areas, in order that the reader may obtain a fairly definite picture of the forest situation in the province as a whole.

"Of the great area of 146,702 square miles which is classed as inaccessible to commercial companies, it is estimated that 7,295 square miles is occupied by water. This and other information is derived in part from aerial photographs which have been taken of 37,851 square miles of that area. Besides this source, there is a good deal to be learned about thenorthern half of the province from the reports of geological and other surveys, and from the accounts of travellers, particularly those who have done extensive flying over the area.

"The southeastern corner of the inaccessible area is contained in the drainage of the Severn river, which flows east into Ontario and then north to empty into James Bay. This watershed has been completely photographed, and the pictures show a large proportion of waste land and very little merchantable wood.

"North of this watershed lies Island lake, with its eastern extremity touching the Manitoba-Ontario boundary. This lake has been frequently visited by aircraft and is now the centre of considerable interest on account of possible mineral developments. Timber of merchantable size is to be found on islands and headlands,

particularly towards the eastern end of the lake."

"Little is definitely known of the Hayes river drainage below Oxford lake, but such reports as are available indicate that the country is very poorly wooded." It will be noted, "that the lower part of this drainage system approaches the treeless tundra belt, which in itself is strong evidence of the absence of commercial timber." The recent development of mining activity in the neighborhood of Oxford lake, God's lake and Island lake, has caused a great deal more accurate knowledge to be derived with respect to the forest resources in this hitherto inaccessible area. It has been found, for instance, that the amount of timber in these districts is more than ample to meet the requirements of all the developments here, including not only timber utilized for mining purposes proper, but also logs and lumber required for mine buildings and houses. It has also been ascertained that, although, in many instances, merchantable timber occurs in small stands only, these stands are by no means isolated and are not so sporadic in occurrence as was formerly thought. While it is not possible to attempt an accurate estimate of the timber in these areas, it is known that the aggregate would represent quite a sizeable figure.

The same condition obtains along the route of the Hudson Bay railway, and in the vicinity of the Burntwood and Grassy rivers, although in the valley of the latter the merchantable timber occurs in stands of larger area, andnot in small scattered bluffs.

The Kississing lake district is known to contain stands of merchantable timber, and it appears from reports that the sheltered

valleys of the Churchill and its tributaries contain timber of fair size.

Improved systems of road building and of transportation in the bush are constantly being developed and the demand for timber is gradually progressing towards our more remote forest areas. With this trend in mind, the establishment of industries dependent on timber from areas previously included in the inaccessible belt, becomes much more of a reality than was considered possible even a few years ago.

CHAPTER XI

FORESTRY PRACTICE

Forestry is the art or science of producing in perpetuity the largest possible yields of timber from non-agricultural soils; but while securing forest products may be the first consideration, the forests provide for other needs of almost equal importance. They should be managed so as to conserve water supplies for power and other purposes, to protect wild life, and also provide the maximum amount of recreation for our people.

Forestry may be subdivided into five branches as shown below:-

Forestry -
1. Forest Policy
2. Forest Protection
3. Silviculture
4. Forest Utilization
5. Forest Management - summation and application of 1-4.

Under the heading of Forestry practice it is convenient to discuss Silviculture and Forest Management, while the other headings will be taken up in other sections.

Silviculture

Silviculture is the art of reproducing and maintaining forests so as to secure the best possible return, and the method of applying this art in securing continuous crops of timber is called a silvicultural system of management. The object of silviculture is to produce the largest crops of the best kinds of timber, in the least possible time and with the least expense.

In order to secure continuous crops of timber it is necessary to provide in some way for proper reproduction either while the timber is being gradually removed, or in some cases after the entire

stand has been harvested. This may be accomplished either by natural or artificial means.

There are two methods of securing natural reproduction:-

1. Seed scattered from trees.
2. Coppice from sprouts or root-suckers.

Most of the coniferous trees such as the pines, spruce, balsam and tamarack reproduce entirely by seeding. The one exception to this in Manitoba being the black spruce which may occasionally be reproduced by layering, that is one of the lower branches covered by moss may develop into a new stem.

In Manitoba sprouting is confined to hardwoods or broad-leaved species; although the white poplar or aspen reproduces almost entirely from root-suckers. When hardwoods are cut, dormant buds at the base of the stump or root collar, develop and form new stems, and in the case of aspen, shoots are sent upward from root-suckers.

The question of whether a forest should be managed so as to secure natural reproduction, or whether artificial seeding or planting be employed, has always been an important one. Much can be said in favour of either method, but local conditions will be the determining factor. Until recently in some European countries, Germany particularly, clear-cutting and planting was favoured. Of late years, however, this method has been largely discontinued and now practically all countries depend on natural regeneration, where forests can be reproduced in this way. The great advantage of natural regeneration is that it is much less costly than artificial reproduction; this is particularly true in western Canada

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where labour costs are usually high. A further advantage is that natural regeneration follows nature more closely as it reproduces those trees or mixtures of trees best suited to the site or location. There will also be less soil disturbance or erosion as the ground will always be protected by some forest cover.

While artificial reproduction by planting may be generally successful in countries of high rainfall, this method is more or less uncertain in western Canada, with our low precipitation. During drought periods, loss of young plants has sometimes been heavy.

In order to secure proper reproduction there are four recognized silvicultural systems practiced in Europe and in America;-

1. The selection system
2. Clear cutting system
3. Shelterwood system, or stand method
4. Coppice system

Each of these systems may be varied in practice to suit local conditions and requirements.

Selection System

In the selection system, what is known as selective cutting is carried out. Trees are removed either individually or in groups when they reach maturity, and there is a general succession of young trees growing up to take their place. In this way the forests are continuously productive. It is one of the easiest systems applied. All trees should preferably be marked by trained foresters for removal, but by fixing a minimum diameter limit, which allows only such trees to be cut as have reached what may be considered a mature diameter, fairly satisfactory results may be obtained.

This is the best system to use in connection with wood-lots, the larger trees being cut, while the smaller are left to grow and develop, seedlings taking the place of the trees removed. This system of course means that we must have an uneven aged stand, that is, trees of all ages from seedlings to mature trees.

The advantages of the selection system are:-

1. It is easily applied to virgin forests where a large staff of highly trained personnel is not available.
2. It maintains forest cover and prevents erosion and floods.
3. It is inexpensive, but logging costs may be slightly higher.

Clear Cutting System

There are a great many variations of this system. In some the forest is clear-cut, in others strips cut against the prevailing winds are removed and seed allowed to blow in from the remaining trees. In other cases reproduction is secured from seed trees or from surrounding forests, the seed again blowing in to the cut-over area. The clear-cutting system is advisable under conditions where trees are shallow rooted and there is danger of them being wind-thrown; where trees are growing in even-aged stands, where logging can be done more cheaply by removing the whole stand, and where reproduction is present and can be protected. It is also advisable to use this method where the trees are intolerant of shade and need full light. This method can only be successfully used with light seeded species, that is, where the seed can easily be carried by the wind. The dis-

advantages of the clear-cutting method are that it exposes the soil and allows the intrusion of grasses and weeds. In countries of low rainfall, such as western Canada, the young trees left exposed may be killed by drying out of the exposed soil, and it might be difficult, if not impossible, to secure satisfactory reproduction.

Shelterwood or Stand Method

In this system of management reproduction is secured by means of thinning the stand at regular intervals. It can only be applied to an even-aged stand and to tolerant species that are wind-firm. Cuttings are made at frequent intervals to open up the stand and allow the sunlight to reach the ground, providing favourable conditions for seed germination. The advantages of this system are that by regular cuttings large numbers of seed trees are left evenly distributed; a new stand is established in advance of the final cutting; it permits the use of heavy seeded species and undesirable trees may be removed during the thinnings. The disadvantages of this sytem are that it requires particularly favourable market conditions in order to dispose of small sized material; logging is expensive and it requires a highly skilled staff to supervise the operation.

Coppice System

Most of our hardwoods reproduce readily by sprouts and root-suckers. In the case of practically all hardwoods in Manitoba, bycutting the stump low during the winter months, excellent and assured reproduction follows. As a rule an area should be clear-

cut in order to provide the greatest amount of light for the young trees. However, variation in the coppice system may be made, in which certain seedlings are left for a second cut. These seedlings originating from seed, will assist in rejuvenating the stand.

While any one of the previously described silvicultural systems might be followed, very often local conditions such as markets, topography and type of timber, may make changes necessary and some combination of one or more of the systems mentioned may prove more successful.

The selection and shelterwood systems of cutting are now the ones generally used in practically all European countries, and in America, and these sytems have been used for some years in Manitoba. On forest reserves all trees are carefully selected and marked for removal. This allows us to remove inferior trees, or trees of less valuable species, so that the stand is gradually improved. In areas outside forest reserves where it is impossible, owing to lack of sufficient staff, to mark trees individually, minimum diameter limits are fixed. This permits the cutting of mature trees only; the younger trees being allowed to grow and reach development.

In the case of hardwoods, the coppice or sprout system is used. In some cases we permit clear-cutting; in others we leave the smaller trees to grow for a later cut.

Forest Management

Forest management deals with the management of the forest

to get the best use of the property. It assumes in advance a correct Forest Policy, efficient Forest Protection, good Silviculture and economical Forest Utilization. In other words, it deals with the summation and the application of the four subjects mentioned above.

Forest Management may be subdivided into four sub-divisions, as outlined below:

Forest Management
1. Forest Mensuration
2. Working Plans
3. Forest Finance
4. Forest Administration

In a narrower sense Forest Management deals only with (2) Working Plans, of the last arrangement. This is the sense in which it will be used here.

For the province as a whole the plan is that the timber shall not be depleted by utilization, fire, insects, etc., at a greater rate than the annual growth. Further, coniferous timber is not to be depleted at a greater rate than the Permissible Depletion, which is set at a considerably lower figure than the annual growth.

The cutting of poplar is to be encouraged in every possible way so as to secure revenue which would otherwise be lost through disease and old age.

One of the simplest ways of regulating cut is by the increasing or decreasing of dues to discourage or to encourage the cutting of different species and products. This method has been satisfactorily ~~used~~ to some extent.

Another method is to restrict cutting in old areas near settlements, which in many cases are being overcut, and thus to encourage the cutting of areas further back, which are more expensive to log but usually have mature or even over-mature timber.

The ultimate objective will be to have the permanent forest area divided into working plan units, each of which will have its own working plan on the basis of sustained yield. Each of these working plan units should have the age classes of its most important species arranged in such a way that each age-class, (usually taken in 10 or 20 year groups) should be equal in area. At maturity each of these age classes should produce equal volumes. In this case the annual yields are equal and this equal yield is sustained or continuous.

Preliminary working plans are already in operation on the Duck Mountain (for spruce) and on the Turtle Mountain (for poplar). Some preliminary surveys have been made on the other Forest Reserves, but here Forest Management has not gone beyond the prohibition of cutting of immature timber.

On areas outside Forest Reserves, the forest staff is too small to give individual attention to all cutting. To prevent, stripping of certain areas where very little mature timber exists, twenty-seven townships were closed last fall to cutting of all softwoods or of certain classes of soft-woods. This system will be continued until such time as a more complete system can be enforced.

TREE PLANTING

While we depend, by the use of proper silvicultural cutting methods, almost entirely on natural reproduction of our forests, there are certain sites in the southern parts of the province where grass, shrubs or poplar competition is so severe that natural regeneration of spruce or pine is slow or altogether lacking. The grass or shrub areas at least are best re-forested by using nursery grown planting stock. The replacement of poplar by more valuable species is sometimes desirable, but is a very difficult operation. Underplanting of poplar with spruce has usually proved unsuccessful--except in very open stands, due to root competition and shading, and it is therefore necessary to remove the poplar before planting is undertaken. Unless special measures are employed to kill the poplar roots by severe burning, these trees reproduce themselves by suckers so rapidly that they seriously retard the planted spruce.

Planting is expensive, costing between $10.00 and $15.00 per acre, and for this reason, must be confined to those areas most easily protected from fire. Plantations should be near good markets, so that when thinnings and the mature timber are sold, the returns will be high enough to cover the cost of planting, plus compound interest for the full rotation of the trees.

The areas in Manitoba which are best suited for artificial planting are the following:

1. Grassland areas on the Spruce Woods Forest Reserve.
2. Grass, shrub and poplar covered areas on the Turtle Mountain Forest Reserve.
3. Grass areas and thinly stocked jackpine areas on the Sandilands Forest Reserve.
4. Burned over areas on the Porcupine Forest Reserve, more particularly the eastern slope of the hills, burned over in 1919.

Planting operations are being undertaken on all these locations, the nurseries being located as follows:-

Lake Max Nursery	--	Turtle Mountain Forest Reserve
Shilo Nursery	--	Spruce Woods " "
Marchand Nursery	--	Sandilands " "
Birch River "	--	Porcupine " "

The objective for the Turtle Mountain is the introduction of white spruce, slightly outside its natural range. Experimental plantations made as early as 1913 show that spruce makes very good growth on this area and can be established in open and shrub-covered areas.

On the Spruce Woods it has been found that the pines are the only species that can stand the severe dessication of the hot summer winds. For this reason jackpine is particularly well suited, although experiments are also being carried out with Lodgepole Pine, Scots Pine and Red Pine. Spruce is reproducing itself naturally around the parent trees but only where the ground is protected from the drying effect of sun and wind by mats of ground cedar (Juniperus horizontalis). The spread of spruce by this method while important, is very slow.

The Sandilands Forest Reserve is fairly well stocked with jackpine,-black and white spruce occupying the lower ground. A little Red Pine is found growing naturally, this Reserve being on the extreme edge of its range. The objective here is to increase the amount of the Red Pine in proportion to the Jack Pine. Conclusions to date are that this can best be done under the partial shade of open Jack Pine stands. Heavy Jack Pine stands give too

heavy a shade for underplanting, while open grassland planting suffers severely from isolation and drying out by wind.

The Porcupine Forest Reserve which is on the whole well-forested with spruce, jack pine and poplar has unfortunately its eastern slope and most accessible area almost entirely denuded of forest cover. This is the result of fires beginnning with the construction of the railway around the foot of the hill in 1901, culminating in the huge fire of 1919. The objective here is to replant with both spruce and pine, using the former on clay and loam sites and the latter on sand and gravel.

Planting was started in a small experimental way in Manitoba in 1904. Continuous planting did not commence until 1930. To date we have planted some 2,507,000 trees and have successfully established plantations on 744 acres, which area we consider fully stocked.

Earlier plantations suffered severely as the seed in most cases was secured from milder climates and the trees suffered severely from winter killing. The seed now being used is either collected locally or is of known hardy origin so that losses from this cause have been eliminated.

The number of trees that have been planted of each species is as follows:-

Jack Pine	943,000
Lodgepole pine	205,000
Red pine	386,500
Scotch pine	436,000
White spruce	529,800
Norway spruce	2,300
Blue spruce	4,000
	2,507,000

THE FARM WOODLOT

Almost every farm in Manitoba has some waste land unsuitable for the growing of field crops. It may be stony ground, a gravel ridge or an area too rough to break and cultivate. Why not utilize this poor land for growing trees and, in this way, make it revenue producing?

Not only will the well managed small farm woodlot produce sufficient fuel for the settler but, if the proper species of tree is planted with others in the lot, it will provide him with material for the repair of farm machinery, tools, etc., These trees will to some extent assist in retaining moisture and retarding evaporation.

While it is expected that woodlots will generally be located on land unsuitable for cultivation, it might be possible to select such areas in the neighborhood of farm buildings where the trees would provide a wind-break and some shelter for stock. This latter does not mean that stock should be permitted to graze within the woodlot itself as this should not be allowed. The tramping of cattle destroys the root cover and slows down the tree growth, in addition of course, to killing much of the young reproduction.

The species of tree to be used in farm woodlots can only be decided upon after all the factors involved have been carefully studied. Of first consideration is the matter of site. By this we mean the type of soil, drainage, exposure, etc., The settler must then decide the purpose for which the trees are to be grown; if for fuelwood alone or if for fuelwood, material for repairing machinery and other farm equipment and perhaps even timber for sale.

Certain species of trees are best suited for dry sandy soils, others must have heavy, well drained clays and loams and again others prefer low damp areas. Care must therefore be taken in the selection of the proper species of tree to suit the site, conditions and requirements. Where native trees already occupy the area selected, and where they are suitable for the settlers needs, these should be retained and additional species added if so desired.

The proper management of a woodlot does not require a high degree of training, merely the use of common sense. In the first place the settler should see that the area is fully stocked with trees, preferably of different ages, and in cutting remove only the mature timber which will be replaced by natural regeneration. If, however, a new plantation is established it will take some time to reach this stage and the settler must depend for sometime on thinnings for his fuel requirements. In planting, young trees are spaced only a few feet apart and may number two or three thousand trees, or more, to the acre. This is necessary in order to secure tall, clean trees of good form and to establish a crown cover which will shade out the grasses and conserve moisture. As the trees increase in size however, some will be over-topped and suppressed and these should be thinned out and used for fuel. The final stand, or those left to reach maturity, may not be more than 500 to 1000 trees per acre.

The yield per acre of fuelwood from farm woodlots will vary, depending on the soil, moisture conditions, the species of tree,

mixture of trees used, and the degree of stocking; but the farmer should secure annually from one-half cord per acre on the poorer stands to one cord on areas fully stocked and on the better sites.

Hardwoods or broadleaved trees as a rule, such as white poplar, green ash and Russian poplar are more rapid growing, more easily handled and give better yields than the softwoods or conifers, such as spruce, jack pine, etc., although excellent results have been obtained with some of the softwoods at the Dominion nursery at Indian Head.

Estimating that the value of the fuelwood consumed on the average farm is $75.00 per year and that there are 55,000 farms in Manitoba, if each settler secured his fuel from his own woodlot, the total value of these woodlots to the province would be in the neighborhood of $4,000,000.

Summing up the farm woodlot:-

(a) Utilizes and makes waste land on the farm, produce a revenue.

(b) Provides the settler with his fuel and material for small repairs to machinery and equipment without cash outlay, and may even produce some additional timber for sale.

(c) Provides shelter in some cases for farm buildings and to some extent conserves moisture and retards evaporation, thus improving farming conditions.

(d) Will add to the beauty of the farm, improve living conditions, and certainly increase the value of the land.

CHAPTER XII

INDUSTRIES

Sawmills

The first recorded use of timber in Manitoba dates back to early in the eighteenth century when fur traders of the Hudson's Bay Company and the North West Company established forts and trading posts in Manitoba from Pembina and the Turtle Mountains in the south, to York Factory, Norway House and Cumberland House in the north. These forts and trading posts were necessarily built of round and hewn logs and any flat lumber required for floors, roofs, etc., was manufactured by whip-sawing or pit sawing. In addition to building the forts and other buildings of timber, canoes and later York boats were constructed of native timber, the fur trade depending, of course, almost entirely on water borne transport.

Not only was the timber in Manitoba used for local requirements of the fur traders but records show that as the fur brigades proceeded west on the Saskatchewan river to the Rocky Mountains they secured their supplies of cedar for canoe building from Cedar lake on the way west.

The early settlers in Manitoba of necessity procured their supply of timber for the erection of farm buildings from the closest local source of supply and many of the settlers now living will remember cutting and hauling logs for buildings, in some cases long distances from the nearest stands.

Again it is likely that the supplies of flat material were procured by whip sawing logs-- the earliest type of sawmill.

The first sawmills operated by power were established in and around Winnipeg. Logs to supply these sawmills were driven down the Red river from some of its eastern tributaries such as the Roseau river flowing from timbered country to the south east. Other logs were brought down in booms and rafts from Lake Winnipeg, some of which were sawn at the mouth of the Red river. Gradually small sawmills were installed on the shores of Lake Winnipeg further north, at points convenient to supplies of timber, such as the mouths of the Winnipeg and Manigotogan rivers on the east and Fisher Bay and Washow Bay on the west. Mills were also established on some of the islands such as Black Island and Hecla Island.

Mr. D. E. Sprague operated a sawmill on Higgins Avenue, Winnipeg, for a number of years. This was finally closed about 1912. The supply of logs for this mill, some of which was red pine, was driven down the Roseau and Red rivers to the mill.

The late J. D. McArthur erecected and operated a double side circular mill at Lac du Bonnet, having a capacity of approximately 100,000 ft. B.M. per day. This mill ceased to operate in 1920.

The Rat Portage Lumber Company, who operated a large sawmill in St. Boniface, ceased to operate in 1916. The output of this mill had for some years been in excess of twenty million feet B.M. per year, the logs being mostly railed in from points east of Winnipeg.

When the Canadian Pacific Railway extended its main line west across the province, sawmills were built on the Assiniboine and some of its tributaries at points suitable for receiving logs driven down the rivers from the Riding and Duck Mountains.

The pioneering lumber firm of this district was Mitchell & Bucknell who first logged the Boggy Creek and Shell River area in 1883 and 1884, when an average season's output was from two million to three million feet B.M. This operation was later taken over by J. A. Christie, and then sold to J. H. Hanbury who organized the Hanbury Lumber company of Brandon, and who continued to log in what is now the Duck Mountain Forest Reserve, driving logs down the Shell and Assiniboine rivers to Brandon where they were manufactured. The average yearly output of the Hanbury mill was between five and six million feet B.M. The logs for this mill were driven approximately 300 miles, the drive taking anywhere from two to three months. This mill ceased operations in 1913.

The building of the original Canadian National Railway from Gladstone to Dauphin in 1896 opened up a new country to the lumber industry. This line was extended in 1897 to Winnipegosis; in 1900 to Swan River and Hudson Bay Junction, and in 1902 it was extended west to Grandview and Roblin. These railway lines have always been to a considerable extent logging railways, and even now, over a considerable portion of them, a large part of the car loadings consist of lumber, cordwood, pulpwood, etc.

Among the more notable operators who came in with these north-western railways may be mentioned the late Honourable T. A. Burrows, at one time Lieutenant Governor of the province, who owned large sawmills at Grandview and Bowsman river. The mill at Grandview was closed down in 1920, although there are still some seventy-five million feet B.M., or more, on timber berths in the Duck Mountain Forest Reserve. The large Burrow's mill at Bowsman River had a capacity of 250,000 feet, B.M. per day, and manufactured between fifteen and twenty million feet B.M. per year. This mill was closed in 1930, although there was still a large amount of timber lying adjacent to this mill, both in the Porcupine Forest Reserve in Manitoba, and on the upper watershed of the Woody River in Saskatchewan.

Shaw Bros. of Dauphin operated a mill from about 1893 to 1906 in the Riding Mountain Forest Reserve, now the Riding Mountain National Park, at a point about fifteen miles south of Dauphin. The lumber from this mill being hauled to Dauphin by settlers and either used locally or shipped from that point. The average cut at this mill was about two million feet B.M. per year. When this mill was closed Shaw Brothers moved to Prairie River in Saskatchewan, and continued operations at that point.

Mr. Peter McArthur, lumbering under the name of The Standard Lumber Company, logged on Lake Winnipegosis from 1897 until 1927. His method of operation was to establish portable sawmills at various points on Lake Winnipegosis, such as Red Deer Point, Big Island, Graves Point and Spruce Island. The rough lumber from these mills was rafted or barged to the village of Winnipegosis

where it was re-sawn, planed and shipped out by rail. Mr. McArthur cut and manufactured from four to six million feet B.M. per year. The Standard Lumber Company timber berths were sold to The Manitoba Paper Company in 1927, and the mill was dismantled.

Mutchenbaker Brothers operated a sawmill at Mafeking from 1903 to 1913. The logs for this mill came from the Porcupine hills and the foothill country immediately adjacent. The greatest output of this mill was about 6,500,000 feet B.M. per year.

Caverley & Sons, later the Caverley Lumber Company of Bowsman River, have operated a mill continuously since 1899 until the present time. The logs for this mill are secured from the southern part of the Porcupine Forest Reserve, the timber being manufactured at a sawmill located near the timber, and later hauled by settlers to a re-saw and planer located at Bowsman River. Their average cut is between three million and four million feet B.M. per year.

The Red Deer Lumber Company operated a large sawmill and planing mill at Red Deer lake, a spur line about six miles long connecting the mill with the Canadian National Railway at Barrows Junction. This company had large holdings of timber both in Manitoba and at nearby Saskatchewan points, and manufactured about twenty million feet B.M. per year. Operations were suspended in 1924, and their remaining timber berths were sold to other companies.

When the Canadian National Railway was extended from Hudson Bay Junction to The Pas in 1909, the Finger Lumber Company erected a large sawmill at that point. The log supply for this mill however, was secured from Saskatchewan and driven down the Carrot and Saskatchewan rivers. In 1910 this company sold out to Winton Brothers, one of the large American lumber companies, who enlarged the mill to a point where it had an annual output of over thirty five million feet B.M. per year. This is the largest mill in the prairie provinces. While the log supply for this mill heretofore has been secured entirely from Saskatchewan, it is expected that a certain portion of their cut will be secured from Manitoba points in the near future.

From the foregoing it will be seen that practically all the large mills which manufactured lumber in Manitoba twenty-five or thirty years ago have ceased to operate and the sawmills have been dismantled. The reason, of course, was the exhaustion of the timber supplies available for such mills. Cutting alone was not entirely responsible; unchecked forest fires, for which the lumber companies themselves were largely to blame, burned much more timber than was actually cut. Uncontrolled settlement in the timbered areas also created a high hazard and was to a great extent responsible for destruction of the timber. Had an efficient fire fighting organization been established and settlement been properly controlled in the wooded areas during the early days of lumbering, the industry would not have declined but rather have increased in importance, with resulting benefit to the province.

At the present time we have in Manitoba approximately two hundred sawmills of various kinds. These vary in size from mills cutting only a few thousand feet annually to mills manufacturing up to six or seven million feet board measure. The majority of the mills are, however, small and are operated by settlers who farm during the summer months. Lumber produced at these mills is used locally.

The largest mill now operating in the province is that of The Pas Lumber Company. Logs to supply it are at the present time secured entirely from Saskatchewan. The next largest mills in order of importance are The National Timber and Fence Company plant, on the northern side of the Porcupine Forest Reserve, cutting about seven million feet per year. Brown & Rutherford, operating on Lake Winnipeg and barging the lumber by water to Winnipeg, manufacture from five to six million feet B.M. annually and The Caverley Lumber Company of Bowsman River, who secure their timber from the Porcupine and cut approximately four million feet B.M. per year. The production of the numerous other small mills varies from a few thousand feet to about one million board feet annually.

The history of the sawmill industry in Manitoba, as in other parts of Canada, has been, first, to build small circular sawmills to supply local community needs. These were later followed, as transportation facilities were established permitting the export of lumber to outside markets, by larger sawmills, cutting not only to supply local demand, but for shipment to points outside the province. As the demand increased, the capacity of the mills became greater and during the peak of production the output was chiefly from these large mills. When stands of virgin timber became de-

pleted, or hauling distances became too great, these mills were closed down or decreased in number, and small mills again became the dominating factor in the industry. Those small sawmills can be moved from point to point and be operated profitably in small scattered stands of virgin timber, and in some cases in areas of second growth.

As elsewhere in Canada future sawmill operations will be carried on by small sawmills. More efficient and less wasteful mills will be built and these can be moved from place to place with very little expense. The overhead and expense of operating such a sawmill is only a fraction of that formerly required for a big mill, and in periods of depression, closing down one of these small sawmills for a time does not mean heavy carrying charges on a non-producing plant. It is also possible that sawmills may in the future be operated in combination with pulpmills. By taking out sawlogs during a pulpwood operation, overhead expenses will be reduced and logging costs lessened.

The daily capacity of the small sawmill of the future will probably be from 10,000 to 20,000 board feet per day.

PULP AND PAPER INDUSTRY

Pulp and paper in Canada is manufactured in three kinds of mills; those manufacturing pulp only; combined pulp and paper mills, and mills manufacturing paper only. The pulp mills manufacture pulp only, which is either sold in Canada or exported. In the combined mills, the pulp manufactured is usually used in the same mill for paper making, while in the mills making paper only, all their raw material is purchased in the open market.

There are four different ways of making wood pulp, -- one mechanical and three chemical. One cord of wood produces approximately one ton of groundwood or mechanical pulp while, on the other hand, it takes two cords of wood to make one ton of chemical pulp. The following are the four different methods generally used in America today.

Mechanical Process

In this process coniferous wood, such as spruce, balsam, etc., is preferred. The peeled wood, and peeling may either be done at the mill or at the point from which shipment is made, is held by hydraulic pressure against a revolving stone and the wood fibres are carried away in a stream of water to be washed and prepared for pulp or paper making. The yield is about 2,000 pounds per cord of wood. Groundwood pulp produced in this way contains all of the wood substances, a part of which is very durable. The fibres are usually short, having been broken up in the process of manufacture. Groundwood is used mixed with chemical pulp in the manufacture of newsprint, wall paper, cheap book paper, tissue, wrapping paper and building paper, and for wall board and other types of board.

The Sulphite Process

This is the most important process and produces the highest quality of pulp, only coniferous woods such as spruce and balsam being used. It depends on the action of an acid bi-sulphite liquor. The wood is first broken into small chips and the liquor added.

It is cooked under high pressure and at a high temperature. The yield is roughly 1000 lbs., or slightly less, per cord of wood. Sulphite pulp is used for the manufacture of the better classes of white paper and boards, either pure or mixed with other fibre. In newsprint, from twenty to twenty-five per cent of sulphite pulp is used, the balance being groundwood. The best quality of bleached sulphite fibre is used in the manufacture of artificial silk or rayon.

Soda Process

This is the oldest process used in manufacturing pulp, and the wood of the so-called hardwood or broad-leaved trees, such as poplar, can be used exclusively or almost so in this process. The wood and other fibres are digested in various forms of equipment with a caustic soda solution which combines with the acid constituents of the non-fibrous parts of the wood, and leaves pure cellulose in an insoluble state. The yield averages about 1,100 lbs., per cord of wood. The fibre, while weak, is used as a filler mixed with stronger pulp in making the best classes of book, magazine and writing paper, and although the paper manufactured from this pulp lacks strength, it takes a good finish.

Sulphate or Kraft Process

The term sulphate pulp originally meant a thoroughly cooked pulp capable of being bleached, and was made by digesting chips with sodium sulphate and sulphide liquors. The term kraft pulp was originally intended to mean practically uncooked pulp. The process was originally developed to reduce the cost of manufacture

of soda pulp by the substitution of salt cake for the more expensive soda ash. Later developments, however, showed that by an adaption of these methods the stronger fibres of coniferous woods, such as jack pine, can be used to advantage. At the present time in Canada, coniferous woods are used exclusively in this process. Cooking is carried on only long enough to obtain fibres that can be separated. This process gives a yield of approximately 1,100 lbs., per cord, and the resultant fibres are long, flexible and strong. Pulp manufactured by this process is used in making kraft wrapping paper, bags etc., and a small quantity may also be used in manufacturing newsprint.

Chemicals used in the manufacture of wood pulp

Sulphur is used, together with limestone or lime, or sometimes sodium carbonate or soda ash in the preparation of cooking liquors. Liquid chlorine, lime and caustic soda are used for preparing bleach liquid for bleaching chemical fibres, while common salt and soda ash are used in the manufacture of chlorine for the same purpose. Salt cake or sulphate of soda, soda ash and lime are also used in the manufacture of sulphate or kraft fibre, while lime and caustic soda are used in the soda process. Pulp stones of course, are used in ground wood pulpmills. It is also possible to use pyrite concentrate as a substitution for the production of sulphite liquid. Some alum is also used.

Pulpwood Used

It is difficult to define pulpwood. There is a serious overlapping, not only in size but in species between what may be termed pulpwood and saw timber. New processes or refinement of processes already in use for the manufacture of pulp, are changing the proportion of different species of wood used. From an economic standpoint it would seem desirable to manufacture all our wood into pulp and paper rather than into lumber. A thousand feet B.M. lumber is worth approximately $25.00 at the mill. The same volume of timber manufactured into paper would, on an average, be worth $60.00 or $70.00

The capital used and number of men employed in erecting and operating pulp and paper mills, far exceeds the money or men necessary for a lumber operation. Again the great bulk of the timber used in pulp or paper making would be quite unfit for the manufacture of lumber.

The development of the pulp and paper industry in Canada has been very rapid. At the beginning of this century the total annual value of production did not exceed $8,000,000.00 while in 1929, the peak year of the industry, the output of Canadian mills was valued at approximately $244,000,000.00. After that year there was a decline in the paper industry owing to lack of markets, until a low point was reached in 1933 of only $123,400,000.00. A gradual increase in production followed, and in 1935 the output reached a value of $162,650,000.00. In 1935 there were 95 pulp and paper mills in Canada.

Over expansion in the newsprint industry and fluctuating markets for this product have left this industry in a more or less uncertain condition. Many of the larger companies have gone into liquidation, and at the present time, mills are operating at less than 50 per cent of their capacity. It is therefore unlikely that any newsprint mills will be constructed in the near future.

While the newsprint industry in Canada is in an unsatisfactory condition, many of the mills manufacturing both newsprint and other pulp products in the United States, have about reached the end of their timber supplies, and must look elsewhere for new locations for their plants. Canada is the most likely place to which such mills could be moved. We have large supplies of raw material, ample hydraulic power, either developed or sites awaiting development.

We have at the present time, one pulp and paper mill in Manitoba, the Manitoba Paper Company. The mill is located near the mouth of the Winnipeg river at Pine Falls, about 70 miles north-east of Winnipeg. This mill, which manufactures newsprint exclusively, has a capacity of over two hundred and fifty tons per day. While this company supplies newspaper in both Manitoba and Saskatchewan with their requirements, the greater part of the output is shipped to United States points.

A model town has been constructed by the Company to house the staff and mill operators, and it has all modern conveniences, electric light, water and sewer systems, hospital, school, theatre and other recreational facilities. This town is probably one of the most attractive in Manitoba.

Until recently the greater part of the wood supply for this mill was purchased from settlers in different parts of the province, but the Company are now securing increasing quantities from their own pulpwood berths, situated on Lake Winnipeg and on the northern end of Lake Winnipegosis.

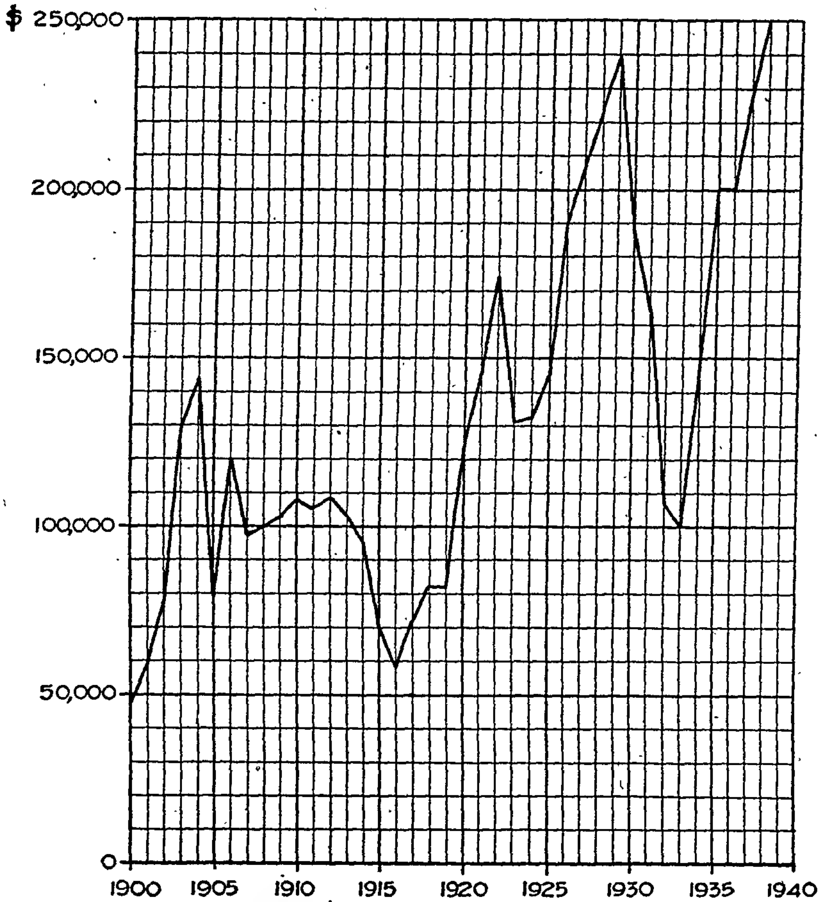
The Pine Falls mills uses approximately 90,000 cords of wood per year, when running to capacity, making about 75,000 tons of newsprint. To produce this quantity of wood requires the employment, during the winter months, of between 2,000 and 2,500 men, equipped with teams, trucks, tractors, etc., In addition to those employed in taking out pulpwood, the staff officers, mill operators and townsite employees number about 350 and these of course, are employed throughout the year.

Manitoba is in a position to provide wood for at least two more pulp mills, providing our timber resources are given reasonable protection. Due to the over expansion of the newsprint industry, any new mills will probably be erected for the manufacture of sulphite or kraft pulp, either for export or for the manufacture in Manitoba into tissue, kraft paper or various types of boards. Owing to failing wood supplies in the neighbouring states, it is quite possible that some of the mills located there may consider moving into Canada in the near future, in which case Manitoba might interest them.

The province has almost unlimited supplies of poplar (populus tremuloides) which manufactured by the soda process is used in making the best book and magazine papers, and by mixing with a portion of higher grade pulp, into letter paper.

REVENUE FROM CROWN FORESTS

MANITOBA



Unfortunately the market for these papers is limited, but it may be possible at some future date, to interest producers of this class of paper in Manitoba.

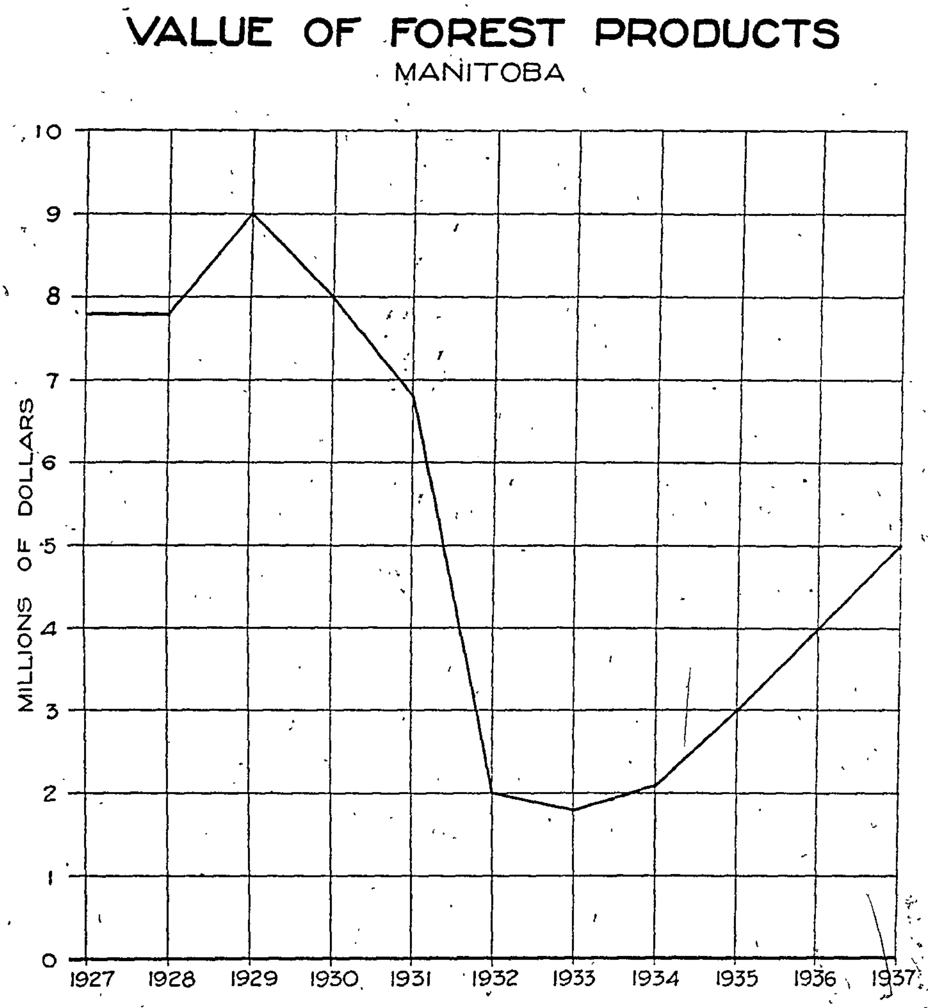
SECONDARY INDUSTRIES

In addition to primary manufacturing plants, we have some seventy-nine secondary wood using industries, manufacturing sash and doors, interior and exterior finish, boxes, excelsior and other similar products. Capital invested in these secondary industries amounts to $3,820,000.00. Nine hundred men are employed and the yearly out-put is valued at slightly over $2,500,000.00

Other Timber Industries

Manitoba forests, besides supplying timber for sawmills and pulp mills, produce many other products used in a semi-manufactured or unmanufactured state. We now cut from both private and Crown lands, yearly about 450,000 railway ties, 1,000,000 fence posts, 500,000 to 600,000 cords of fuelwood, 100,000 cords of pulpwood, and quantities of other timber, such as telephone poles, building logs, mining timber, lath and shingle bolts, boxwood and shimwood. Most of this material is used locally, only small quantities being shipped from the province.

During the long winter months a slack period of employment exists both for farm labour and those employed in the constructional trades. Work in the woods, employing both men and teams, helps very considerably in filling in this gap, as from ten to fifteen thousand men are employed during a greater part of each winter in our forests, and hundreds of farm teams used, in skidding and hauling logs, pulpwood and other timber products.


VALUE OF FOREST PRODUCTS
MANITOBA
MILLIONS OF DOLLARS
0
1
2
3
4
5
6
7
8
9
10
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937

MARKETS

A large part of the lumber manufactured from Manitoba timber is used locally. The balance is shipped as far west as Regina and Saskatoon, to points as far east as Oshawa in Ontario, and to points in the United States, particularly within the states of Wisconsin and Illinois. Owing to our having only a limited supply of mature white spruce which must fill our requirements until such time as our large areas of young growth reach saw timber size, it is unnecessary to look for new marktets for lumber at the present time as the quantity cut should not be increased for some years.

The price secured for our sawn lumber in Manitoba is entirely too low. The manufacturer is not receiving sufficient in many cases to pay interest on the capital invested, and government dues do not cover the cost of fire protection and supervision over the hundred years necessary to produce mature saw timber. Unfortunately this condition cannot be remedied, or at least not until British Columbia reaches the end of her easily accessible and cheap timber supplies. The higher grades and larger sizes in British Columbia lumber are mostly exported to Europe. This leaves what is known as "side lumber", which corresponds to our common spruce grades, the principal markets for which are the prairie provinces and China, the latter being a very uncertain customer. The result is that any betterment in European markets is reflected in an increase in the timber cut in British Columbia, with a consequent large accumulation of "side lumber" which is dumped on the other provinces, breaking the price of that locally manufactured.

The only pulp and paper mill in Manitoba manufactures newsprint exclusively. The product of this mill can be sold only as far west as Moose Jaw, Regina, and Prince Albert, freight rates preventing shipment to points further west. Some of the newspapers in Manitoba use paper manufactured at Pine Falls, others do not. The greater part of the output of the Manitoba Paper Company mill is exported to the United States, shipments being made to points as far south as Dallas, Texas. The newsprint market has been an uncertain one for years, depending entirely on whether conditions in the United States are prosperous or not. Exhaustion of pulpwood supplies of at least some American mills is indicated, and this may improve market conditions.

While small quantities of pulpwood are exported to Ontario, and the United States, this is not encouraged as prices paid in Manitoba, owing to high freight rates, are low. It is hoped new mills may be established in the province, making kraft and other papers, in which case exportation to the United States should be prohibited.

Railway ties are purchased by both the Canadian National and Canadian Pacific railways, who confine their purchases almost entirely to No. 1 and No. 2 standard ties. No. 3 ties are sometimes used on branch line sidings and also by the Greater Winnipeg Water District railway and power companies. Of late years we have insisted that all waste parts of the tree and tops be made into fuelwood. It is doubtful if any change in market conditions could be made, the requirements of the different railway companies being the controlling factor.

Fuelwood now cut on Crown land is taken from dead, dying or diseased trees or parts of trees salvaged from other operations and from poplar of commercial size. The quantity of fuelwood purchased

in this way might be greatly increased if it were not for high transportation costs; for, while it is easy to dispose of such wood in the neighborhood of Winnipeg, much is going to waste in the northern and western parts of the province.

The quantity of building logs, piling, telephone poles, fence posts, boxwood, shimwood, etc.,,cut depends entirely on local needs and the cost of transportation. Improved methods of transportation, lowering such costs, will to some extent increase the markets for at least some of these products.

A careful study should be made of possible future markets, especially for such species as poplar and jack pine. Large quantities of these species are going to waste. The following might be investigated:-

1. Pulp mills manufacturing products other than newsprint.
2. Factories manufacturing furniture, implements and wooden ware of all kinds, now being imported, particularly those using hardwoods.
3. Wood distillation and the manufacture of charcoal, etc.,
4. The use of waste products from mills and from timber operations of all kinds.

WOOD PRESERVATION

By wood preservation is meant the protecting of any type of structural timber such as bridge timber, sills of buildings, telegraph or telephone poles, railway ties, fence posts, mine props etc., from decay or damage by insects. This is accomplished by impregnating the wood used with preservative oils, soluble salts or other toxic material which renders the timber immune to attack by fungi or bacteria which cause decay or insects which consume and weaken it.

The natural result of the increasing practice of treating wood

with preservatives is to decrease the drain on our forests and therefore help in conserving our timber resources. Authorities in some countries claim that the annual loss through decay of wood in construction, may equal as much as one-fifth the yearly cost of standing timber. Not only would the use of treated timber assist in conservation of our forests, but a very large sum of money would be saved annually in replacing decayed timber in all kinds of wood structures. In many cases the cost of replacement greatly exceeds the value of the timber used. Railway companies realize this and very few untreated cross ties are now placed in their tracks.

Over 900,000 fence posts are used annually in Manitoba, the greater part being cut from the farmer's own woodlands. The usual life of a post varies, depending on the species of tree used. Untreated aspen poplar lasts only four or five years, while round cedar averages about twenty-two years.

An interesting experiment has been carried on at the Dominion Forestry Nursery at Indian Head, Saskatchewan, treated posts being placed in the ground together with untreated ones, and careful observations made to determine the result. The posts were treated by different processes with creosote oils or soluble salts.

The first experiment was tried with Russian poplar, probably one of the least durable woods. A number of posts treated with creosote oil by the open tank method were used, together with untreated ones as a control or check. In four years the untreated

posts had all rotted off at the ground, while the treated posts showed no sign of rot, after being in the ground nineteen years. From this it would be safe to predict that properly treated posts, even of inferior species, will last at least six or seven times as long as untreated ones, and outlast even the best round cedar posts. The cost of treating small numbers of posts at Indian Head with creosote oil was 17 cents each. If larger numbers are treated this cost might be considerably reduced. If creosoted posts were generally used in Manitoba, it would mean a saving of possibly three quarters of a million posts per year and a large saving in time and money in making replacements.

Wood preservatives may be grouped into three general classes:-

1. Preservative oils, such as "Creosote oil", "Coal tar", "Petroleum oils", etc.,
2. Soluble salts such as "Zinc chloride" and "Sodium fluoride", soluble in water.
3. Toxic chemicals such as "Arsenic" in various forms or "Mecuric chloride", the solvent being other than water.

The soluble salts and toxic chemicals have a strong tendency to leach out of the wood and are therefore unsuited for treatment of any timber which may come in contact with moisture. However, a new proprietary combination consisiting of sodium fluoride and dinitrophenol, claims to have overcome this tendency to leaching. This mixture is sold in the form of a powder, and when mixed in water is applied with a brush to peeled green timber. The treated material is then placed under shade for a month or so before using. This preservative, if it proves satisfactory, could be easily used on the farm as it is clean and easily applied.

Creosote oils are generally used and give good protection. There are several methods used in applying them. The simplest way is to brush creosote oil on well dried timber. While the penetration is not great, a fair measure of protection is given. It is possible to use the more effective open tank method on a farm where small timber such as fence posts are to be treated, tanks or large barrels being used. The posts would be first placed in a tank of creosote headed to from 180 degrees to 200 degrees F., and after some hours placed in a tank of cold creosote until cooled.

There are many different methods of applying wood preservatives. Only the most simple have been discussed here. It must be apparent, however, that their general application to structural timbers subject to rot will mean a great saving, both to companies and to the individual, and very materially assist in forest conservation.

CHAPTER XIII

RECOMMENDATIONS

During the depression of the last few years it has been necessary to exercise the strictest economy in forestry as well as in other services. The result has been that little or no improvemont work has been undertaken and very little new equipment purchased. Many of the recommendations made in this chapter will necessarily call for increased annual expenditures and it is realized that these suggestions can only be carried out if, and when, additional money is available. However, it should be understood that money spent on forests will give splendid returns, will mean increased yield in the future, provide new revenue for the government, and the enlargement of existing industries and the establishment of new ones which will, of course, provide additional employment for our people.

FIRE PROVENTION

Losses from forest fires in Manitoba, as well as in other parts of Canada, are much too high. These could be greatly reduced by increasing the staff of our fire organization, improving our means of communication and transportation, and improving our fire fighting equipment. The following are some of the more important suggestions which should be considered:-

SUGGESTIONS

1. An increased staff of forest and fire rangers is necessary, so as to reduce the size of the ranger districts allotted each ranger.

   Note: Each ranger in Manitoba is responsible for maintaining protection against fires over approximately one million acres of land, while in European countries each forest guard is allotted only two or three thousand acres.

2. Additional technical staff should be employed to study:

   (a) Weather conditions and the effects of weather in relation to the occurrence of forest fires;

   (b) Improved methods of detecting and suppressing forest fires;

   (c) Improvements in fire fighting equipment.

3. Amendments should be made to the Manitoba "Fires Prevention Act", compelling the removal, from both private and public lands, of all brush and debris which might create a fire hazard, and increasing the penalties for carelessness resulting in forest fires.

4. The air patrol should be enlarged by increasing the number of planes, equipment, and personnel; while further summer bases should be established throughout the north, so as to give a greater measure of protection to those areas.

5. Fire Detection

   (a) Erect more observation towers and provide the necessary men to man them.
   (b) Provide more effective means of communication between towers and bases by the use of short wave radio and by the extension of the forestry field telephone system.

6. Suppression.

   (a) Improve existing roads, trails, portages, etc., and, where possible, build more, so that all parts of the forest may be reached with a minimum of delay with fire crews and equipment.

   (b) Increase the number of trucks, power boats, aeroplanes, gas cars, etc., used in moving fire crews and equipment so that they may be transported as rapidly as possible to the scene of fire.

   (c) Build further fire guards and where possible divide the forest into smaller units, either by fire guards or trails, in this way providing base lines from which fires may be fought and enabling the rangers to confine fires to these smaller units and reduce losses.

7. Education.

   More attention should be given to educating the public in the value of our forests in order to secure their support in protecting them. Carelessness or indifference is responsible for the majority of forest fires.

8. Municipal Organization.

Municipal fire fighting organizations should be improved to provide for the more effective suppression of prairie and bush fires. Fires in municipalities are usually started by settlers clearing land and in many cases spread to valuable stands of timber.

Overtrapping and Forest Damage

A great deal of damage is done to young trees in our forests by the rabbit or varying hare, the losses being particularly sever during periods of abundance. Leaders, or tips, of young coniferous trees, protruding through the snow, are nipped off and seedlings, and even trees up to two inches or more in diameter, are killed, the latter by girdling. While no estimate has been made of the number of trees killed or permanently injured from this cause, it is known that rabbits seriously interfere with, and are largely responsible for the imperfect reproduction of our forests.

Nature, if undisturbed, usually maintains a natural balance between herbaceous and carnivorous animals. However, in many of the more accessible forest areas, this natural balance has been badly upset by heavy overtrapping of the fur bearing predatory animals which feed on rabbits. The rabbit population no longer kept in check by these enemies, multiplies rapidly with consequent heavier damage to the forests.

Trapping in the more valuable forest areas should be carefully controlled so as to maintain a proper balance and prevent over abundance of such destructive species as rabbits. This will prevent serious damage to the young forest growth and assist in providing better reproduction.

Insect and Disease Control

Insects and fungi are responsible for heavy losses of timber and in some cases these losses have reached enormous proportions. No exact estimate of such damage has ever been made, as very few trained men have been available to make the necessary surveys. Control in the case of insect outbreaks is usually obtained by the introduction of parasites, although in some cases of insect infestation, and generally in the case of fungus diseases, silvicultural methods may be employed.

The great difficulty at the present time is the lack of trained entomologists and plant pathologists, who can recognize outbreaks before they reach epidemic proportions, and suggest or provide means of control while the infestation is in the incipient stage.

While the Dominion Government is doing what work is possible with the small number of men available, an effort should be made to secure more entomologists and pathologists and to provide the necessary laboratories for study and development of parasites.

Land Classification

A complete survey and classification of all provincial lands should be made as soon as possible in order to determine the suitability of these lands for various purposes. Lands unsuitable for farming or ranching should be permanently set aside for the growing of timber. Foresters must prepare working plans for forests which may not yield mature timber for fifty years or more, and any necessary improvement work in connection with protection

or management should be based on definite permanent units. When ownership of land is continually changing, successful forest management is impossible and money expended on improvements wasted.

Where settlement has occurred on non-agricultural or sub-marginal lands, more particularly within the wooded areas, and where it can be shown that it is impossible for such settlers to maintain themselves on these lands by farming, they should be moved to other parts of the province, preferably to better agricultural lands within existing municipalities where schools, churches, roads, etc., are already available, and where they can become self supporting. The non-agricultural lands vacated in this movement should be permanently reserved for the purpose of growing timber.

Forest Reserves

The setting aside of forest reserves for the perpetual growing of timber and the permaent withdrawal of such areas from sale or settlement has proved entirely satisfactory. Until reserves are established, proper working plans cannot be made, nor an efficient protective system, with the necessary improvements, such as roads, trails, towers, telephone lines, etc., provided.

At the present time the forest reserves in Manitoba comprise only 1.5 per cent of the total area of the province as compared with 3.9 per cent in Saskatchewan and 8.1 per cent in Alberta.

When the necessary funds are available for their development, new forest reserves should be established in suitable areas, and in some cases existing reserves should be enlarged to take in those sub-marginal lands adjacent to their boundaries that have not been

settled or which were formerly homesteaded and abandoned as unsuitable for cultivation, and which in many cases have been taken over by the municipalities for non payment of taxes.

Supervision

While quite advanced silvicultural systems are now in practice in Manitoba, these have been based on general, rather than on detailed information. It has been almost impossible to carry out intensive forest surveys with the small staff of technical foresters now employed.

Although very definite conditions regulating the cutting of timber are attached to, or form part of all permits issued, and all sales agreements, these are sometimes poorly carried out, owing to the carelessness, or indifference of the operators. Cutting operations should be very carefully supervised by trained rangers under the direction of technical foresters in order to insure that only those trees authorized to be cut are removed, and waste of timber prevented in order to provide for proper future regeneration. At the present time, owing to the very large districts allotted to each ranger, it is sometimes impossible for them to visit an operator more frequently than once a month. This is far from adequate supervision.

When money becomes available, the number of both technical foresters and forest rangers should be largely increased.

Farm Woodlots

An effort should be made to encourage the establishment of permanent woodlots on farms so that the settler may grow his own fuel-wood and possibly small quantities of timber for other purposes. The farm woodlot should not be compared with the private forests of Europe, nor with privately owned timber lands of the United States and eastern Canada, which are usually large areas of forest entirely separate from cultivated lands, and which, in some countries, are being brought under government regulation or control.

An educational campaign which would convince farmers of the many advantages to be gained by having timber growing on what would otherwise be a waste and unprofitable part of the farm, would probably produce good results. Possibly an arrangement might be made with municipalities, as has been done elsewhere, to make some reduction in taxes on land which has been set aside on a farm for the growing of trees.

Central Nursery

At the present time the Forest Service is operating forest nurseries on the Sandilands, Turtle Mountain, Spruce Woods and Porcupine forest reserves. These nurseries are situated near ranger stations and have been cared for by the ranger when he could spare time from other duties, with some assistance during the planting season. This method of handling nurseries is not satisfactory. The planting and seeding season occurs during the spring fire season and the ranger must, to some extent, neglect one or the other. During the early years when only a few thousand trees were being planted in experimental plots, very little of the ranger's

time was required at the nursery. Now, however, when we are planting over a million trees a year, it requires the full time of several men to properly care for the plants.

<u>It is recommended that a central nursery be established at some convenient point in the province, which will grow all the planting stock necessary, and that the present small and scattered nurseries be closed.</u> Tree stock can be grown much cheaper in quantity than in small lots.

<u>Utilization</u>

Logging in Canada has always been an extremely wasteful operation. It is estimated that in connection with the logging and manufacturing of lumber fully fifty percent of the tree is wasted and every effort should be made to reduce this loss. In Manitoba we require that all tops of trees cut for other purposes, which are marketable, shall be made into fuel-wood or some other product; but there is still too much waste in many of the operations.

<u>A careful study should be made of this phase of forestry by trained men who should endeavor to find new markets for the utilization of what is otherwise an economic loss.</u>

Sawmills in Manitoba use the circular saw, which cuts an unnecessarily wide kerf and many of the sawmills are in poor condition and thus produce a poor quality of lumber which further reduces the amount of lumber secured from the tree. Where possible, bandsaw mills should be introduced and trained men should be available to advise and instruct mill owners in the most economic methods of manufacture.

In addition to using every effort to reduce the waste in logging and manufacturing timber, the public should be induced, where possible, to use wood preservatives to prolong the life of timber used in structural work, particularly in the case of fence posts and other timber products coming in contact with the soil. Not only will this lessen the cost of frequent purchase of new posts, etc., but there will be a large saving in the labor cost of replacement.

Saving the waste of timber in logging and manufacturing and prolonging the life of timber products by using wood preservatives will be of great assistance in conserving our forests.

Development of New Uses and Markets

The supply of mature white spruce in Manitoba, suitable for the manufacture of lumber, is limited and the present annual cut should not be increased. However, when the young growth, now forty or fifty years old, reaches merchantable size three or four times the quantity of timber will be available annually and new mills will be required to handle the cut. In the case of species other than white spruce the situation is somewhat different and in many cases we are cutting only a fraction of the annual growth or increment. It is in connection with this surplus in certain species that a study should be made, and if possible, new industries established and markets found. Much of this timber is overmature, is deteriorating and will die and become a total loss.

There are large areas of black spruce in Manitoba, much of which is over-mature. This species seldom reaches saw timber size, but makes the best possible pulpwood. There are also quantities

of balsam which are suitable for pulpwood but of little use for other purposes. Some effort should be made when conditions improve to interest capital in establishing pulp mills in the north western part of the province where the most of this timber is situated.

We are using only a small portion of the annual growth or increment in the case of poplar and every effort should be made to find new markets and new industries which might increase the use of this species. While poplar is used largely for fuelwood in Manitoba, a small quantity is manufactured into lumber, box-wood, etc. A greater quantity might be used for these purposes if improved methods of drying were developed. It is also possible that poplar might be used in the manufacture of small woodenware, now imported, while no doubt many other new uses might be found for this species if careful investigations were made.

Oak, elm, and ash in Manitoba are usually found in the river valleys and have heretofor been considered relatively unimportant. However, if we consider the great mileage of river valleys in the province, it can readily be seen that we have important quantities of these woods. It should be possible to establish small industries, making bent-wood and other cheap furniture, tool handles, handles, etc. for farm implements and other similar products, and provide a continuous supply of hardwoods for such factories.

New uses for wood are being continuously discovered; clothes, sugar, artificial silk, food for cattle and even power for gas-driven engines can now be obtained from wood. With the exception of

artificial silk or rayon it is unlikely that any of these products could be manufactured profitably and sold in Canada. However, the forests will become increasingly more valuable as time goes on, new discoveries will be made, and new and better methods of production developed.

Development of Recreational Areas.

Many of the forest reserves in Manitoba contain numerous beautiful lakes situated in hill or rock country that are well adapted for summer resort locations and for camping purposes. This is particularly true of the Whiteshell Forest Reserve, which lies east of Winnipeg in Pre-Cambrian formation, and contains some two hundred lakes of varying size.

These lake areas should be developed for recreational use as rapidly as possible, and roads, summer resort sites, docks and other facilities provided in order that they may be available for recreational purposes for the people of Manitoba.

Further, if these recreational areas were properly developed and advertised they would, no doubt, attract tourists from other provinces and the United States, and thus provide a most welcome and prolific source of new income for the province.